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Integrating Psychological Operations into the
Joint Theater Level Simulation (JTLS)

THESIS

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Integrating Psychological Operations into the

Joint Theater Level Simulation (JTLS)

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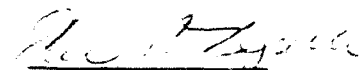Simulation (JTLS)

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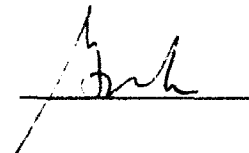| COMMITTEE:	NAME/DEPARTMENT	SIGNATURE
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Preface

I would like to thank my wife, Shelly, for her support and encouragement and the time she gave me to allow me to write this thesis. She put up with many late nights and long days; her patience and understanding are greatly appreciated.

I would also like to thank my advisor, Major Negrelli, for his support and guidance. He let me develop the thesis in the direction it needed to take, and kept me focused on the final goal. My sponsors. Lieutenant Colonels Brandt and Smith, also provided invaluable assistance and motivation throughout the research and writing of this thesis.

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Abstract

This thesis provides a prototype and methodology for integrating psychological operations (PSYOP) into the Joint Theater Level Simulation (JTLS) combat model. The requirement rose out of the need for aggregate-level training models to reflect the role of PSYOP so that commanders and their staffs can learn how to manage, plan for, and conduct PSYOP within the context of AirLand battle doctrine. As the JTLS model currently exists, there is no representation of psychological operations whatsoever.

This thesis outlines a methodology for incorporating the PSYOP analysis process (including the target audience analysis), the PSYOP product development and production process, the PSYOP product dissemination, and an estimation of its effects(if any) on military and civilian target audiences. Military target effects are explicit estimates; civilian effects are modeled on the aggregate level. The goal is an estimation of the impact of PSYOP on battlefields within the JTLS combat simulation. This thesis contains an overview of the JTLS model and a listing of data sources and assumptions.

I. Introduction

In <u>Force-on Force Attrition Modelling</u>, the author, James Taylor, defines models as "...*representations of reality*. They may be representations of states, objects, events, or processes. All models are idealizations (i.e. abstractions) in the sense that they are less complicated than reality (38: 5)." James K. Hartman notes that "A model's representation of the real system is never perfect. Insignificant aspects of the real system are omitted from the model on purpose, and invariably significant aspects of the system's behavior must also be abstracted and simplified in the model (28: 1-2)."

Depending on a model's purpose, some combat processes may be omitted for the sake of speed, ease of use, or other factors which the designer deems more important than representation of the omitted processes. This may also be unintentional. It may be that new processes and procedures have developed since the model's inception or new doctrine and tactics cannot be simulated to the degree desired by the user. Model users may consider some of these omitted processes important.

Currently, this is occurring within the Joint Theater Level Simulation (JTLS). JTLS's owner, the Joint Warfare Center, desires enhancement of JTLS and has identified a need to have psychological operations represented in their theater level conflict model. This thesis will address that need.

Before I outline the mission of the Joint Warfare Center, I need to provide some background. The Goldwater-Nichols Department of Defense Reorganization Act took effect in 1986. This act rearranged the U.S. military command structure and created what are referred to as "theater CINCs," or theater commander-in-chiefs. Essentially, these theater CINC's, during time of war, have control over all Army, Navy, Air Force, and Marine assets fighting within their respective theaters. CINC's are divided into two groups: unified and specified. Generally, unified CINCs are responsible for U.S. military interests in a specific portion of the world, for example,

U.S. Atlantic Command (USLANTCOM). Specified CINC's, on the other hand, are responsible for a specific activity. For example, all U.S. special operations forces fall under the U.S. Special Operations Command (USSOCOM).

The Joint Warfare Center was initially formed as a result of a Joint Force Initiative Program between the Chiefs of Staff of the Army and Air Force. It originally reported to U.S. Readiness Command (the precursor to U.S. Forces Command, USFORSCOM). Later it transferred to U.S. Special Operations Command, then later moved back under USFORSCOM. In 1989/90, both the Army and Air Force decided to eliminate funding and support for the JWC. However, the Chairman, Joint Chiefs of Staff (JCS), directed that the JWC be continued and transferred to the JCS. In April 1990, JWC was chartered as a fully-joint, Field Operating Agency of the JCS.

THE JWC's chartered mission statement is:

"The Joint Warfare Center supports the Chairman, Joint Chiefs of Staff, CINC Joint Exercise and Training Programs with Computer Simulations, and:

- Assists the CINC's in exploring the applicability and feasibility of integrating computer simulations in exercise and training events.

- Assists the CINC's in developing simulation-supported exercises to include such activities as coordinating the interfacing of existing models.

- Provides direct exercise support including the use of JWC resources.

- Assists the CINC's in assessing the effects of computer simulation design of exercise results and lessons learned.

- Advises Joint Military Education and doctrine development organizations regarding joint warfare exercise simulations."

The JWC reports to the JCS J-7. The Chairman, Joint Chiefs of Staff (CJCS) owns - staffs and funds - the JWC. The JWC supports the CJCS, the JCS, and the CINC's. By extension, other users are accommodated on a non-interference basis with advice, assistance, and/or short term equipment loans.

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In addition to the charter tasks, the JWC manages the JTLS model and the Joint Conflict Model (JCM) model for the joint community. These are both configuration controlled models that are modified and maintained in response to all user requests as directed by their respective governing configuration control board. Hence, indirectly the JWC supports all users of these simulations and the users of other simulation support tools developed to support CINC-sponsored exercises (9).

1.1 Overview

This thesis provides the methodology for modeling the psychological operations (PSYOP) of United States forces as an enhancement to the Joint Warfare Center's theater level conflict model, Joint Theater Level Simulation (JTLS). The methodology allows the JTLS programmers to integrate psychological operations into the current JTLS computer model.

1.2 Background

Most conflict models can be described as having either training or analysis as its primary purpose (4: 3). Purpose refers to the reason the model was constructed or how the model is being applied -- these may not be one in the same. Frequently, a model designed for analysis may be used as the driver for a training exercise (or vice versa).

Such is the case with JTLS. Originally implemented in 1983, it was designed as an analysis model. Specifically, its purpose was described as "primarily to analyze theater-level operations plans. [It was] designed as [an] operations support and force capability tool for evaluating different mixes of forces or resources (20: jtls.txt)." JTLS developed from a training simulation known as the Joint Exercise Support System (JESS) (35). JESS has since developed into the Corps Battle Simulation (CBS). CBS is used by the Battle Command Training Program (BCTP) to train corps, division, and brigade staffs. It is also used by BCTP as a seminar trainer

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for military officers attending the Command and General Staff College at Fort Leavenworth, Kansas (20: cbs.txt). JTLS has since crossed over into training and education from analysis as its purpose. For example, in October 1992, JTLS was used as an exercise driver for U.S. Atlantic Command during Exercise Spartan Base '92. This exercise was used to train the CINC-level commanders and staff on joint operations.

Today, JTLS is used by U.S. Atlantic Command, U.S. European Command, U.S. Special Operations Command, U.S. Southern Command and other unified and specified commanders as a tool for training their joint staffs and evaluating and analyzing theater-level operations plans.

1.2.1 Psychological Operations Background

As stated in section 1.1, this research will specify a methodology to integrate psychological operations into JTLS. This section will provide some background on psychological operations by addressing questions such as, "What are psychological operations? Where do they fall in the scheme of U.S. military operational forces? What are some of the general objectives, methods, and limitations of psychological operations?"

British military analyst J. F. C. Fuller first used the term "psychological warfare" in the 1920's. He imagined that someday combat as he knew it might "be replaced by a purely psychological warfare, wherein weapons are not used or battlefields sought...but [rather]...the disintegration of the moral and spiritual life of one nation by the influence of the will of another is accomplished (27:20)."

Presently, psychological operations fall under the umbrella of special operations within the U.S. military. Special operations are operations conducted by specially trained, equipped, and organized forces against strategic or tactical targets in pursuit of national military, political, economic, or psychological objectives (17: Glossary-13). Special operations forces (SOF) are forces that carry out special operations. Psychological operations units fall into this category.

Even though there is some representation of special operations within JTLS, there is no psychological operations process representation whatsoever.

Psychological operations (PSYOP) attempts to influence the attitudes and modify the behavior of a specific target audience in a manner favorable to United States interests. Specifically, DoD Pub 1-02 defines psychological operations as "planned operations to convey selected information and indicators to foreign audiences to influence their emotion, motives, objective reasoning, and ultimately the behavior of foreign governments, organizations, groups, and individuals. The purpose of psychological operations is to induce or reinforce foreign attitudes and behavior favorable to the originator's objectives (17: Glossary-12)." In this endeavor, psychological operations are targeted to influence not only policy and decisions, but also the ability to govern and command, the will to fight, obey, and support (16: Sec H, 7-8). Psychological operations are not used only during wartime. In fact, the NATO definition of psychological operations states expressly that they may occur "in peace or war (17: Glossary-12)."

Within the Department of Defense, the Army--because of its established PSYOP training bases, assigned missions, and land-based operations--has the primary military role in psychological operations. As the service with the principle assets, the Army has the major role in assisting commanders to achieve PSYOP objectives. These objectives can be broken down into the two broad areas of cohesive and divisive objectives (32: 2).

Cohesive objectives include:
1. Developing national unity.
2. Creating favorable images of the government.
3. Providing public information.
4. Improving civil-military relations.
5. Refuting or countering enemy propaganda.
6. Redirecting interests.

Divisive objectives include:
1. Exploiting vulnerabilities or failures.
2. Encouraging dissension among groups.

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3. Undermining confidence in the opposition.

4. Stressing enemy intolerance or prejudice.

5. Encouraging defection.

Traditional methods used in PSYOP include leaflet dropping and radio broadcasts. Leaflet drops date back to World War I, when about 66 million leaflets were distributed by airplane, artillery, and balloon. During the recent Gulf war, Desert Storm, Coalition forces made great use of divisive objectives in its PSYOP campaign. About 25 million leaflets were printed and about half released by allied airplanes, artillery, and rockets over Iraqi troops in occupied Kuwait (15: Appendix J). These leaflets were designed to strike at the basic physical needs or the cultural fears of the Iraqi troops.

For example, on the basis of reports that front-line Iraqi troops received only 1 meal a day, the attached leaflet was designed which showed a cartoon of 3 Iraqi prisoners eating a lavish meal of fruit. Another, based on a report of inadequate medical supplies, promised good medical treatment (1: 24).

Figure 1-1. Sample PSYOP Leaflet

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Similarly, safe conduct cards guaranteed safe passage through Allied lines and fair treatment if surrendering. It contained instructions in Arabic. "If you want to preserve your life, take the magazine from your rifle, carry it on your shoulder with the barrel pointed down, put your hands over your head and walk slowly towards allied outposts with a leaflet held over your head (1: 16)." These proved so effective that Iraqi commanders began severely punishing troops caught carrying these leaflets.

Figure 1-2. Sample Safe Conduct Pass

PSYOP support to accomplish the objectives outlined earlier can be broadly broken into 3 levels: strategic, operational, and tactical. Strategic PSYOP is designed to exploit vulnerabilities in foreign governments, military forces, and populations. This type of support is oriented to advance broad or long-term national objectives and the target audience is usually global in nature. Operational PSYOP is designed to achieve mid-term objectives in support of large campaigns or major operations. The target audience is not nearly as broad as strategic PSYOP and is aimed at regional military forces, governments, or the targeted population. Tactical PSYOP is planned and conducted in the combat area to achieve immediate or short-term objectives. The target audience is

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usually elements of the opposing military force. The leaflet drops described earlier were examples of tactical PSYOP (6:64-65).

Realistically, though, PSYOP is limited by political ramifications, cultural mores, security considerations, media problems, and personnel requirements. For example, during the Korean War, one U.S. leaflet read "Your Place Will Be Empty," and showed a Chinese family at a meal with a skeleton. The skeleton referred to a dead soldier. But in Chinese culture, skeletons are never used to represent ghosts and, thus, the message was lost on its intended audience (6: 3-4). A knowledge of cultural, economic, religious, and social practices is required to be able to produce effective PSYOP.

It is not just U.S. military might, diplomatic skills, or economic prowess that persuades an enemy to stop fighting. If doubts and fears can be placed into the enemy we subsequently improve the chances of getting him to stop fighting. Basically, PSYOP strives to convince the enemy that he has more to lose than win by continuing the fight.

1.3 Problem

The Joint Warfare Center (JWC) at Hurlburt Field, Florida uses JTLS as its primary theater level conflict model. A recent survey of operations research analysts at the unified and specified CINC's have noted that inclusion of PSYOP in modeling/gaming is "very important" to their studies and training (11: Annex D). As JTLS currently exists, no PSYOP play is modeled. As a training tool, users would be better served by including PSYOP in future versions.

When skillfully and closely integrated with military and political actions, PSYOP can act as a catalyst and can make the difference between mission success and failure. To reinforce this tenet, PSYOP must be integrated into existing theater level training exercises sometimes supported by conflict models, since these are what the CINC's use to train themselves, their commanders, and their joint staffs.

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JTLS is currently undergoing an upgrade. Specifically, psychological operations and civil affairs processes will be included. The JWC requires a listing of the specific PSYOP tasks that should be included in the next upgrade of this model.

1.4 Research Objectives

1.4.1 Primary objective. This thesis will develop a methodology of representing current U.S. Army psychological operations doctrine in the JTLS model. This methodology will incorporate the PSYOP analysis process, the development and production processes, the dissemination process, and the determination of PSYOP effects (if any). This is explained in greater detail in chapter 3. The result will be a doctrinally correct model of the use of PSYOP and an estimation of its quantifiable effects. Additionally, this methodology will be generic in nature and be applicable to other theater level conflict models.

1.4.2 Sub-Objectives This research problem contains five sub-objectives:

1. Analyze the Joint Theater Level Simulation model. This analysis will focus on the representation of weapons systems and effects, how combat is modeled, how attrition is affected, and the model decision logic.*

2. Examine in detail the doctrine and tactics of psychological operations. The doctrinal actions and its associated effects form the foundation of the implementing PSYOP into JTLS. Sources for this phase of my research include: current U.S. Army PSYOP doctrine, analysis of PSYOP effectiveness conducted during the Korean War, after-action reports from Operation Desert Storm, and personal interviews with CINC-level PSYOP staff officers and current PSYOP staff officers.

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* This was accomplished primarily during a TDY trip to USLANTCOM as a player/controller/liaison for Exercise Spartan Base 92, a computer aided exercise using JTLS.

3. Select a representation scheme consistent with the JTLS model. Any prototype developed must be able to be integrated into the existing version of JTLS. These prototypes must use existing JTLS structure to affect any changes in combat processes due to PSYOP play.

4. Develop a prototype of PSYOP play. First, develop a list of PSYOP-specific tasks and activities to prototype in conjunction with PSYOP experts from

> U.S. Atlantic Command J35, PSYOP staff
>
> The 4th Psychological Operations Group (Airborne), the only active duty PSYOP unit in the U.S. Army
>
> The PSYOP Officers Course of the Special Warfare Center at Fort Bragg, the only approved professional development course which teaches PSYOP doctrine and tactics in the U.S. Army.
>
> Special Operations Command, Directorate of Psychological Operations and Civil Affairs, the CINC-level staff in charge of PSYOP within the special operations specified command.

Then, within the existing framework of JTLS, determine how to integrate these tasks/activities into JTLS. Finally, insure that the eff .ts of such PSYOP tasks/activities are rational through expert review.

5. Verify the PSYOP prototype for both doctrinal and logical correctness using expert review Again, this review comes from the 4th Psychological Operations Group (Airborne), the Psychological Operations Officer Course, and the Directorate of Psychological Operations and Civil Affairs at USSOCOM.

1.5 Specifications and Assumptions

The following specifications and assumptions will impact on this research:

- Limited time will focus this research on prototyping only. Writing and compiling actual programmed instructions and computer code is beyond the scope of this project.

- As much as possible, the prototype will be compatible with existing JTLS procedures. Any unresolved issues will be noted.

- The decision logic of the JTLS model has been verified. Specifically, the combat events program, which simulates the execution of ground, naval, air logistics, and intelligence

activities, must be verified. Similarly, the attrition logic (based on a full heterogeneous Lanchester model) must also have been verified.

1.6 Scope

This research will be limited to U.S. Army tactical and operational PSYOP doctrine only. Since strategic level PSYOP is controlled by the highest levels of our government and is out of the control of the typical theater level commander, it will not be modeled. While many of the procedures to be developed might equally apply to an opposing force's use of PSYOP, the underlying doctrinal base is limited to U.S. procedures and tactics. No enemy PSYOP directed against U.S. target audiences will be modeled.

This thesis will provide a methodology for incorporating PSYOP into JTLS. The intent of this research is to focus on prototyping, thus, allowing the model experts to manage the details of actual code implementation.

1.7 Summary of Approach

This research will begin with a literature review covering current PSYOP doctrine, the quantitative (and qualitative) effects of U.S. PSYOP on an enemy force (from the Korean War through Desert Storm), and validation/verification of models and expert systems. Based on this review, a list of requirements will be developed. This will outline which specific PSYOP factors and tasks (i.e., leaflet drops, loudspeaker teams, radio broadcasts, etc.) on which this research will concentrate. A set of IF-THEN flowcharts will be developed for each of these factors/tasks. These flowcharts will attempt to quantify the effects of various types of PSYOP. Finally, these will be evaluated by expert review for verification.

Chapter 2 presents a review of the literature relating to psychological operations doctrine, tactics, and effectiveness. Chapter 3 describes the methods used in this research. Chapter 4 discusses the development of the psychological operations tasks prototypes for use in JTLS.

II. Literature Review

The purpose of this chapter is to review the literature relating to psychological operations doctrine, tactics, and effectiveness. Because my goal is to produce a doctrinally correct model, current doctrine is a primary source. Additionally, I relied heavily on a series of studies conducted for the U.S. Army during the Korean War concerning the effectiveness of various psychological warfare tactics.

This chapter will first present an overview of psychological operations throughout history. Next, I will outline current U.S. PSYOP doctrine. Then, I will outline some theories concerning when and how PSYOP is effective. Finally, I will describe how psychological operations are modeled within the Corps Battle Simulation, used by the Battle Command Training Program (BCTP). Currently, CBS is the only simulation used in the Department of Defense that includes any form of PSYOP operations.

2.1 An Overview of Psychological Operations

Psychological warfare is a recent name for an old idea about how to wage successful war. The idea is found in the oldest manuals of military strategy. Sun Tzu's The Art of War, written more than 23 centuries ago, stressed the importance of destroying the enemy's will to fight. "For to win one hundred victories in one hundred battles is not the acme of skill. To subdue the enemy without fighting is the acme of skill (26: 66)."

Consider a case from the Bible. The Israelites had to face the powerful Midianite Army that outnumbered them ten to one. What could the Israelites do? They came to their leader, Judge Gideon, and he, inspired by the Holy Ghost or other supernatural forces, devised a very interesting plan. In that era, an army moving by night had to use one torch for every hundred men. The Midianites had made camp and on the following day planned to attack the Israelites. Gideon

selected 300 volunteers, gave each one a torch and a large clay jug, and instructed each to carry the torch inside the jug. Provided with these and a trumpet, each man was told to surround the Midianite camp from every direction. When Gideon blew on this trumpet, each man would break the jug pitcher and sound his trumpet. They did this at night and the surprised Midianites found themselves surrounded by 300 torches. Through a simple calculation, for every torch there should be 100 men, they found themselves surrounded by 30,000 men. This caused tremendous panic among the Midianites and they lost all reason. Gideon realized that through the planned use of panic, the actions of 300 men could overcome a strong army. The army was practically annihilated on the following day. This is a prime example of what a simple psychological trick can do. (13: 6)

While many have praised the uses of PSYOP, it has (until the past 30 years or so) also been the target of scorn and contempt. Historians have offered a wide range of both substantive and emotional definitions of psychological operations.

Consider what the noted U.S. military historian, General Mark Clark has written:

> "The broad term 'psychological warfare' includes any action that forces
> the enemy to divert men and equipment from the active front, to tie down
> men and arms in preparation for defense against an attack that never
> comes."

Former U.S. Ambassador to India and Governor of Connecticut, Chester Bowles, expressed his disdain for the activity he calls "psychological warfare."

> "Psychological warfare is a cynical phrase borrowed from Goebbels and
> Stalin. If we insist on employing it to describe our activities we will
> continue to lose the respect of millions of people throughout the world
> who were brought up to believe that America is more than a clever
> gimmick or a cynical maneuver (13: 15-6)."

The British describe the activities that Americans broadly characterize as psychological warfare as political warfare. The British were the first western power to establish an agency specifically for the purpose of overseeing psychological operations. The Department for Enemy Propaganda (also known as Crewe House) was established during World War I to coordinate the Allied -- France, U.S., and Italy together with Britain -- propaganda efforts. While the Germans

did cite Allied propaganda as the major reason for their defeat (13: 3), the Crewe House attempt was immature. It was far easier for the Germans to blame PSYOP than to admit to their own citizens that their army got defeated in battle by a superior force.

With the outbreak of World War II, the U.S. had virtually no organized capability to conduct psychological warfare. Although the Army had given psychological warfare token recognition by establishing the Psychological Warfare Sub-Section of G-2 in the War Department, only 1 officer on that staff had any psychological warfare experience at all. Eventually, PSYOP units were created and together with the Office of Strategic Services (OSS, the precursor to the CIA). They mounted an effective PSYOP campaign against the Axis powers. General Eisenhower thought the crusade useful. "Without doubt, psychological warfare has proved its right to a place of dignity in our military arsenal (36: 20-1)."

2.2 Current Psychological Operations Doctrine

In 1986, the Army published its keystone warfighting manual, FM 100-5, Operations. It introduced AirLand Battle doctrine, the Army's approach to generating and applying combat power.

Later that same year, Congress passed and President Reagan signed the Goldwater-Nichols Department of Defense Reorganization Act. One of the provisions of this act placed PSYOP forces stationed in the continental United States (CONUS) under the combatant command (COCOM) of the United States Special Operations Command (USSOCOM), a unified command with global responsibilities. When operating outside CONUS, the theater warfighting commander-in-chief (CINC) has operational control of these PSYOP forces.

These changes led to a revision of the Army's PSYOP doctrine, FM 33-1, Psychological Operations. The most current revision was approved as a final draft in July of 1992. I used this as the basis for answering the following questions:

1. Where is PSYOP used?

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2. How is PSYOP used?

3. What is PSYOP used for?

PSYOP forces operate across the operational continuum. PSYOP are normally joint in nature, but they may support combined services or coalition operations or interagency activities. The operational continuum is the strategic environment in which military forces operate. It divides the environment into peacetime, conflict, and war operations. The application of PSYOP varies with the environment and the level of activity.

THREAT

PEACETIME   CONFLICT   WAR

SECURITY ASSISTANCE

TERRORISM AND COUNTERTERRORISM

INSURGENCY AND COUNTERINSURGENCY (PHASE III)

HUMANITARIAN ASSISTANCE

INSURGENCY AND COUNTERINSURGENCY (PHASES I AND II)

CONVENTIONAL WAR

PEACEKEEPING

NUCLEAR WAR

RANGE OF FORCE STRUCTURE

STRATEGIC FORCES

CONVENTIONAL FORCES

SPECIAL OPERATIONS FORCES (PSYOP)
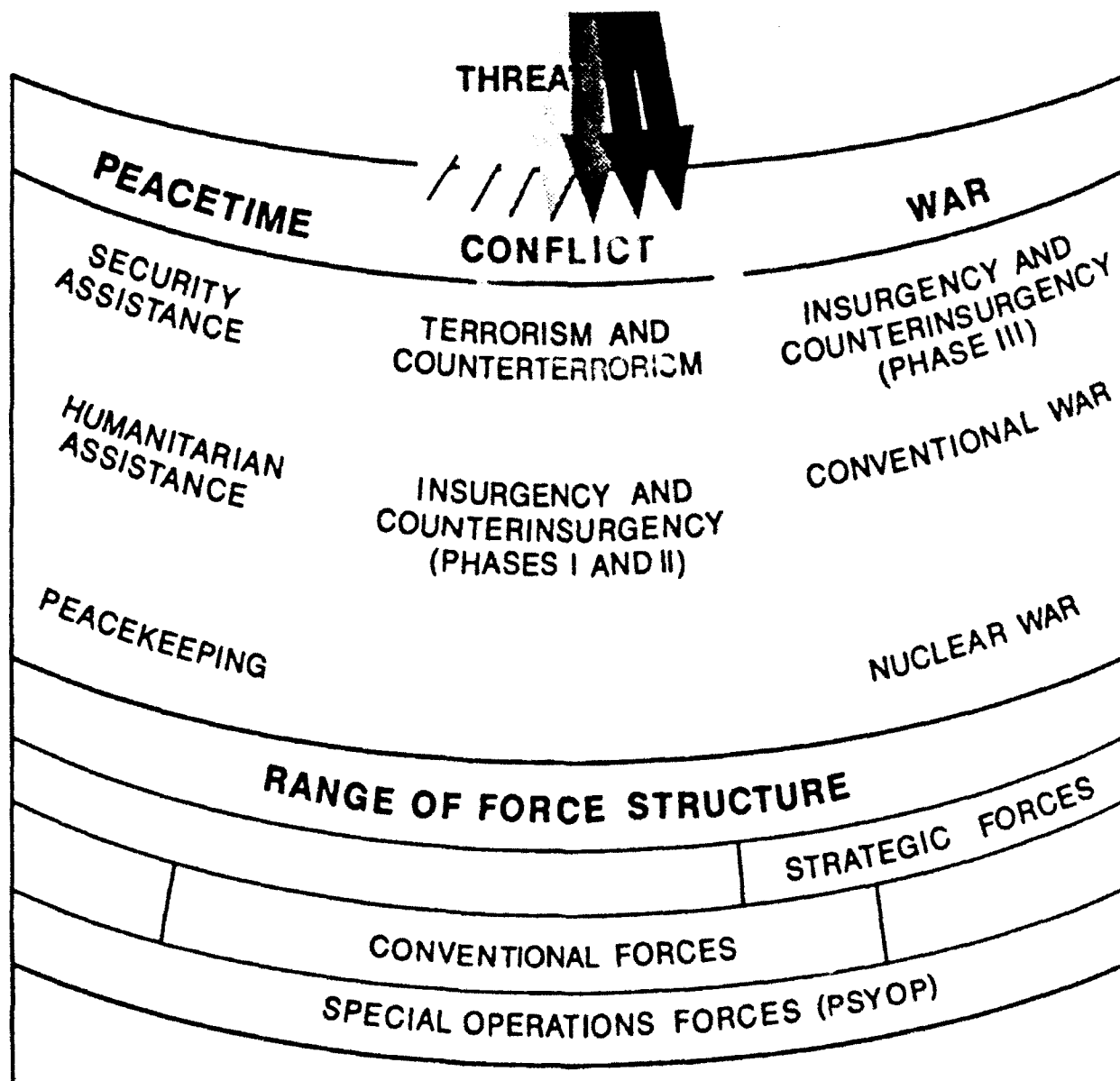
Figure 2-1. The Operational Continuum

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Peacetime is defined as a non-hostile state during which political, economic, psychological, and military measures are used to reach national goals. The measures taken do not involve U.S. combat operations or active support to warring parties. The objective of these measures may include keeping foreign groups and countries from starting hostilities against the U.S., projecting a favorable image of the U.S., or supporting U.S. public diplomacy.

Conflict is frequently a protracted political and/or military struggle between political systems and ideologies. In conflict, the use of general purpose combat forces may only further escalate the situation to unacceptable levels. PSYOP offer the President and the Secretary of Defense (commonly referred to as the National Command Authority, NCA) options for engagement without conventional force use. PSYOP serve in this fight by

- building and then sustaining support for U.S. or allied political systems,

- undermining the credibility and legitimacy of a competitor's politica system,

- mobilizing popular support for political, economic, and social programs consistent with U.S. goals,

- publicizing planned reforms and programs that benefit the populace after a competitor's defeat,

- shifting the loyalty of hostile forces and their followers to a friendly power.

During wartime, PSYOP support operations at the strategic, operational, and tactical levels. For example, prior to the Gulf War, PSYOP actions helped U.S. strategic foreign policy in the Middle East by projecting an ongoing presence there. At the operational level, theater PSYOP actions aided General Swartzkopf's theater campaign plan by, among other things, supporting the deception of an imminent amphibious assault of the eastern coast of Kuwait (3). Tactical PSYOP included the safe conduct passes and surrender appeals mentioned earlier.

A PSYOP program includes products, actions, or a combination of both. A series of PSYOP programs form a PSYOP campaign. In reality, political considerations influence the use or extent of use of PSYOP programs.

Action programs are sequential, coordinated activities (possibly including military operations) conducted for their psychological impact. This may be anything from the drilling of a

well for humanitarian assistance to an aircraft carrier sailing in a region as a show of force. All psychological actions require close coordination with the other services and agencies to ensure proper timing, cohesion, and economy of force. If properly planned, coordinated, and integrated, psychological actions help capitalize on the success of the actions. PSYOP planners can then use that success to influence the target audience's behavior. However, remember all actions have a psychological impact, not just those intended to be part of the action program(s).

Product programs are sequential and coordinated presentations of visual, audio, and audiovisual products designed to enhance the effects of psychological actions. To be effective, a product must attract the audience's attention and convey the intended meaning. Product and action programs are combinations of both.

2.2.1 PSYOP Missions in Support of Deception Operations

Deception is defined as "those measures designed to mislead the enemy by manipulation, distortion, or falsification of evidence to induce him to react in a manner prejudicial to his interests (17: Glossary-8)." Deception may enhance an important principle of war -- economy of force.

The chance of success and impact of the deception operation increase when PSYOP support the deception plan. Each deployed PSYOP unit has linguists and organic equipment to support deception operations. PSYOP units can use printing and photographic assets to produce a wide variety of counterfeit or notional material: excerpts of order of battle documents, movement orders, posters, etc. Radio and television broadcasts can be used to disseminate information to the populace. Radio transmitters can break into an enemy's radio programs and give false news reports to create confusion and chaos. Taped sound effects provided excellent audio deception support during the Gulf War. Major Robert Adolph, a PSYOP officer, stated that "loudspeaker teams were also used successfully ... to simulate the movement of heavy combat equipment in an effort to disclose enemy artillery positions to counter-battery and TAC air fire (3: 9)."

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Surprise is usually a key factor in offensive operations. However, it is not always possible to maintain secrecy while planning a large-scale attack. A deception effort can help by causing the target to believe an attack will occur at a specific location. This, in turn, might cause the enemy to relocate his forces. Other examples might be directives or posters stating that a specific area and the roads leading to it are off-limits to the local populace or spreading deliberate rumors about an upcoming attack, the units involved, or other information to support the deception operation.

A highly successful PSYOP supported deception operation occurred during the Gulf War. Leaflets overprinted with the 7th and 18th Airborne Corps patches were delivered onto Iraqi defensive positions where U.S. commanders wanted the Iraqis to believe the 7th and 18th Airborne Corps would attack (3: 6). Coalition intelligence confirmed massive Iraqi troop movements in reply. The Joint PSYOP Task Force Commander, Colonel Jeff Jones, stated, "CINCCENT [General Swartzkopf] ordered a halt to leaflet dissemination because the deception became too successful (3: 6)."

2.2.2 PSYOP Missions in Support of Consolidation Operations

Consolidation operations are directed to the population in either liberated or occupied areas. PSYOP's major goal in supporting these operations is to attempt to influence the populace to make military operations easier. These try to encourage maximum cooperation with the liberating or occupying power. This may be gained by reorienting and reeducating the population on the U.S.'s goals, policies, and missions (publicizing humanitarian assistance that benefits the populace and explaining the U.S. intentions). Additionally, PSYOP consolidation programs try to end the influence of hostile groups or individuals.

Intimidation stemming from the presence of strong military forces may soften hostility and make the populace more responsive to authoritative direction. Through PSYOP, intimidation is converted into long-lasting, willing cooperation. Minority groups who have humbled themselves for a long time because of race, religion, ethnic background, or socioeconomic status will often

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have feelings of inferiority. Civilians in a war zone are usually weak, apathetic, and in a state of shock. These conditions make them unable to resist authority, thus making PSYOP's job easier. These people may be willing to assist the PSYOP program because of self-interest: they are often dependent on the occupying power for vital supplies and services.

People become accustomed to receiving news and information through specific, well-known, and established sources of media. They are more likely to believe and follow information and instructions coming from such sources. PSYOP can capitalize on these existing habits by using familiar sources, media, formats, and style.

PSYOP can be used to establish law, order, and discipline. Calming the population's fears, preventing panicky movement, and directing their activities into useful channels are all possible through PSYOP. Because the population has been conditioned to accept the imposed controls and restrictions willingly, the number of U.S. troops required to pacify and control the populace is reduced significantly.

Refugees, evacuees, and displaced civilians frequently clog roads and major lines of communication. This, in turn, hinders the movement of combat units, equipment, fuel, and other supplies. PSYOP can help by publishing and broadcasting instructions and information to keep lines of communication open.

Because of the close contact with both friendly and hostile persons, PSYOP often gain information valuable to the intelligence effort. Appeals to the populace encouraging them to report facts on enemy activities can be developed and publicized.

2.2.3 PSYOP Missions in Support of Special Operations Forces Operations

Special operations differ from conventional operations in their degree of risk, operational techniques, and manner of employment. They are often conducted independent from friendly support and dependent upon operational intelligence and indigenous assets. Public law (10 USC

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167) states that special operations activities include direct action, special reconnaissance. unconventional warfare, foreign internal defense, counterterrorism, and other activities specified by the NCA.

2.2.3.1 Direct Action. Direct action (DA) missions are short-duration strikes and other small-scale offensive actions principally taken by special operations forces (SOF) to seize, destroy, or inflict damage on a specified target; or to destroy, capture, or recover designated personnel or material (17: Glossary-8). Common PSYOP objectives in a DA operation are:

- Explaining the purpose of the operation to counter the enemy and to ensure understanding of what has occurred and why

- Establishing control of noncombatants, neutrals, and other groups in the operational area. These actions help reduce casualties and prevent interference with friendly operations.

- Exploiting target audiences that might not be otherwise accessible; demoralizing potential adversaries with the results of the operation.

- Assessing the psychological impact of the operation.

- Reducing the adverse effects of mission failure.

- Capitalizing on mission success in strategic PSYOP campaigns.

2.2.3.2 Special Reconnaissance. Special reconnaissance (SR) operations are actions conducted by SOF to obtain or verify, by visual observation or other collection means, information concerning the capabilities, intentions, and activities of an actual or potential enemy. or to secure data concerning the meteorological, hydrographic, geographic, or demographic characteristic of a particular area (17: Glossary-13). Common PSYOP objectives in an SR mission are:

- Assessing the psychological impact of the operation including the impact on compromise clandestine or covert operations.

- Limiting or negating the effects of compromise.

2.2.3.3 Unconventional Warfare. Unconventional warfare (UW) is defined as the "broad spectrum of military and paramilitary operations conducted in enemy-held, enemy-controlled, or politically sensitive territory. It includes guerrilla warfare, evasion and escape, subversion, sabotage, and other operations of a low visibility, covert, or clandestine nature (17: Glossary-14)." The operations are conducted primarily by indigenous personnel, usually supported or directed in varying degrees by an external source. Common PSYOP objectives in a UW mission are:

- Creating popular support for the insurgent movement.

- Promoting reforms the insurgents will establish after the hostile government's overthrow.

- Developing the support of the population to allow the insurgents to move freely, avoid detection, and aid in recruiting for their intelligence and political infrastructure.

- Discrediting the existing government and its programs.

- Maintaining motivation among the insurgents.

- Passing information or instructions to the resistance organization or their subordinate elements.

2.2.3.4   Foreign Internal Defense.   Foreign internal defense (FID) operations are undertaken by civilian and military agencies of a government in any of the action programs taken by another government to free and protect its society from subversion, lawlessness, and insurgency (17: Glossary-9). Common PSYOP objectives in a FID mission are:

- Improving popular support for the host nation (HN) government.

- Projecting a favorable image of the HN government and the U.S.

- Supporting defector programs.

- Discrediting the insurgent forces to neutral groups; discrediting the insurgents themselves.

- Support HN population control and protection measures; passing instructions to the HN populace.

2.2.3.5 Counterterrorism. Counterterrorism (CT) operations include offensive measures to prevent, deter, and respond to terrorism, intelligence gathering and threat analysis of terrorist

organizations. Typically, this includes hostage rescue, recovery of sensitive material from terrorist organizations, and attacks on the terrorist infrastructure. Common PSYOP objectives in a CT mission are:

- Countering the adverse effects of a terrorist act.

- Lessening popular support for the terrorist cause.

- Publicizing incentives to the local population to inform on terrorist groups.

- Conducting deception operations to mask CT forces intent.

- Limiting or negating the effects of compromise.

- Gain indigenous support for friendly CT forces and actions.

2.2.4 PSYOP Missions in Support of Conventional Operations

Conventional operations can occur throughout the operational continuum in a variety of situations. With the collapse of the former Soviet Union, the U.S. national military strategy has changed to one primarily concerned with power projection. As a result of this shift, the Army's fundamental doctrine is undergoing a major update. However, the 4 basic tenets behind AirLand Battle Doctrine remain unchanged: agility, initiative, depth, and synchronization.

Agility is the friendly force's ability to act quicker than the enemy. PSYOP can disrupt the enemy's coordination, cohesion, and slow his reaction time.

Initiative is setting or changing the terms of conflict by action. PSYOP can help seize the initiative by attacking the enemy's will to fight and influencing him to behave favorably to the friendly forces.

Depth is the extension of operations in time, space, and resources. PSYOP can support deception operations, promote dissidence and defection within the enemy's ranks, counter any enemy propaganda, and sustain the morale of friendly troops and the population of the occupied country.

Synchronization is the arrangement of battlefield actions to produce the maximum possible combat power at the decisive point in time on the ground. The effectiveness of military operations is enhanced by coordinating the planning and execution of a cohesive PSYOP campaign with other military operations.

2.2.4.1 Conventional Offensive Operations. PSYOP considerations are a critical part of all operational planning. During offensive operations, PSYOP is used most often at the tactical level. PSYOP can:

- Exploit the effects of the offensive.

- Increase the effectiveness of heavy ordnance and massed fires.

- Increase or decrease the psychological impact of chemical weapon use.

- Help higher and adjacent units by influencing the enemy's actions outside the boundaries of those units.

2.2.4.2 Conventional Defensive Operations. While maneuver units may remain in a defensive position to gain time, keep ground, or deny the enemy access, PSYOP maintain an offensive momentum. PSYOP can:

- Discourage an enemy offensive.

- Conduct offensive PSYOP against bypassed or isolated enemy units in rear areas.

- Support forces delaying an enemy advance by using deception operations.

- Gain the willing, active support of the people.

- Breed uncertainty and doubt in enemy troops; lower his morale and efficiency.

- Stimulate support of opposition elements against the enemy, especially those within the enemy's territory.

- Strengthen friendly leaders; weaken enemy leaders.

2.2.5 PSYOP Missions in Support of Peacetime Contingencies

Peacetime contingencies may occur in crisis avoidance or crisis management situations requiring the use of military forces to enhance or support diplomatic initiatives. The top levels of the government usually manage contingencies because they require rapid, decisive solutions. Contingency operations can include, but are not limited to, any of the following situations.

Disaster relief is a very high visibility and high psychological impact event. PSYOP can exploit the humanitarian relief efforts by projecting a favorable international image of the U.S.

Noncombatant evacuation operations (NEO) evacuate threatened civilians from locations in a foreign nation. The Department of State directs NEO's. The NEO itself is a strong psychological action of the U.S. resolve to protect its citizens.

Attacks and raids have high psychological impact. Recovery operations may include the recovery of U.S. or friendly foreign nationals, or the location, identification, and recovery of sensitive equipment critical to U.S. security. Successful attacks, raids, and recovery operations have a positive impact on the morale and cohesiveness of U.S. forces. Conversely, a failed mission might require a PSYOP program to counter the negative effects on world opinion.

Security assistance surges occur when a friendly or allied nation faces a threat of imminent harm. The U.S. may speed up the shipments of weapons, equipment, or supplies to the allied nation. PSYOP programs may help to ease tensions in that nation during this time.

2.3 PSYOP Effectiveness Theories

The degree of success of PSYOP is difficult to determine or even approximate. People act from a combination of motives, not from one set alone. During war, it is almost impossible to assess the part PSYOP plays (2: 5). There are no established measures of effectiveness concerning PSYOP. Consider some studies performed over the last 35 years. During Vietnam, the 7th

Psychological Operations Group measured PSYOP effectiveness as the utilization rate of the unit's printing presses, loudspeakers, and radios (8: 2). In his Master's thesis, "A Media Allocation Model for Psychological Operations," Major John Lanigan chose the gross weight of leaflets delivered to the enemy as his effectiveness measure (34: 4). Note that these attempts to measure PSYOP effectiveness used indices of the amount of effort expended or materials used as criterion rather than measures of the kind and amount of PSYOP effects in terms of changes in the target audience consistent with PSYOP objectives (5: 57).

The husband and wife team of Drs. Edith and Ernest Bairdain of Human Sciences Research, Inc. wrote the "Final Technical Report: Psychological Operations Studies -- Vietnam." This report was the first report covering the results of almost 18 months of basic research in psychological operations in Vietnam. The objectives of their study included:

1. To measure the effectiveness of PSYOP programs by developing and validating criteria with which to measure effectiveness according to the specified aims of the PSYOP program.

2. To help develop broad theoretical principles which will provide a general foundation for the conduct of PSYOP in an insurgent environment (5: 4).

They recognized the problem of PSYOP effectiveness and described it with a useful analogy. Consider, a computer chip, or CPU, manufacturing process. A very small wafer of silicon might first be measured and cut to size by a grid, a simple metal instrument with cross-hatched lines that looks like graph paper. Later, it will be tested for electrical conductivity by an oscilloscope, an expensive and complicated instrument that produces wavy lines on a cathode ray tube display device that are interpreted by a trained operator to arrive at a measurement based on the patterns of the shape of the lines. Still later, an infrared laser may test the chip for structural flaws. Finally, a pass-fail measuring device that provides a simple electrical impulse may be used to check the faithfulness with which the CPU, now part of a PC, performs the impulse transmission or rejection function for which it was designed. This reading may be as simple as a blue light for good and a red light for bad (5: 58).

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In the previous paragraph, I described 4 different methods of taking measurements by 4 different instruments, using 4 different measurement indices, each interpreted against different criteria. All of these were required for a determination of the CPU's potential for effectiveness at 4 different stages of production. This is analogous to the tools needed for the estimation of PSYOP effectiveness. Four different types of PSYOP under 4 different sets of conditions, having 4 different objectives, will require at least 4 different measuring instruments (methods) which may lead to 4 different sets of readings for measurements, which will be based on 4 different sets of standards (criteria) (5: 58). It is easy to see why no generally applicable criteria for measuring PSYOP effectiveness exists.

Bairdain and Bairdain found that much of the previously experienced difficulty in measuring PSYOP came, not so much from the innate uncertainty of the subject matter, but from "the failure to (1) distinguish between the approaches appropriate to different aspects or type of PSYOP and (2) failure to distinguish between measurement of the effectiveness of a ... basic PSYOP activity, such as [messages], and the effectiveness of complex PSYOP projects which are multi-faceted, multi-dimensional, and multi-problematic (5: 59)."

They went on to propose a conceptual approach for measuring PSYOP effectiveness. Two theoretical constructs were developed.

> PSYOP Effectiveness in Relation to Degree of External Pressure. Defection is
> most likely to occur as an immediate response to PSYOP messages when appeals
> are received in the context of some form of military pressure. Where timely
> persuasive messages are received, the opportunity exists, and defection is feasible
> in the situation, the potential for inducing defection varies together with the degree
> of pressure (up to a maximum of intensity and duration that varies situationally)
> (5: 61).

> PSYOP Effectiveness in Relation to Degree of Internal Psychological Tension. In
> the absence of exposure to immediate high external pressure, defection may occur
> because of the cumulative effect of a lengthy series of unrewarding, frustrating,
> difficult, and intermittently dangerous experiences that greatly outweigh any

positive features in the total situation (5: 61). By a process of rationalization, the act of defection recommended in the PSYOP message can come to be seen as more and more plausible and advantageous. The incubation period for defection on this basis is from 1 to 2 years depending on the individual and the situation through time (5: 29).

These constructs make sense intuitively, but why does PSYOP work? A closer examination of the theory of sensory overload will explain. Persuasive evidence already exists that excessive stimulation disrupts neural functioning and creates a psychotic reaction. This is well illustrated by the double approach-avoidance experiments with rats. A rodent is starved by food deprivation and locked in a hallway with food at both ends. If he tries to approach the food, he is shocked, regardless of which end of the hall he approaches. Finally, faced with the choice of starving or being shocked, he goes into a state of frenzy or sinks into a stupor. The frenzy or state of violent agitation or delirium is associated with overload and the stupor with deprivation. In both cases, the result is complete disorientation.

Figure 2-2 shows the path along which the human psychological state moves. As the normal or accustomed volume and intensity of the sensory input increases or decreases, the psychological state moves from normal ability to tolerate these stresses towards the upper or lower limits of tolerance. In overload, as stress reaches the "intolerable" stage, the subjective psychological state of the individual moves through successive phases representing progressively diminished contact with normal subjective reality (5: 27).

At a point between mental equilibrium and overload, a zone exists that represents a state of "Heightened Suggestibility" (see figure 2-2). While in this zone, the factors that cause ordinary soldiers to risk their lives (habits, values, belief in comrades, etc.) approaches being equalized or taken over by the total discomfort of their situation. When this is reached, the normally strong control over behavior exerted by habit, training, and conditioning is lessened and the hold on reality is weakened. When this occurs, the most basic instinct of all -- self-preservation -- takes over and the individuals subjected to sensory overload are ready to be influenced to action by any outside

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Total Incoming Stimuli	Resultant Psychological Status	Mental State of the Individual

Intolerable Stimulation	→	Sensory Overload	→	Disorientation
Excessive Stimulation	→	Neurological Disrution	→	Breakdown of Habit
				Heightened Suggestibility
Above Normal Stimulation	→	Physical Discomfort	→	Mental Discomfort
Normal Stimulation	→	Normal Sensation	→	Mental Equilibrium
Below Normal Stimulation	→	Reduction of Sensation	→	Reduced Awareness
Minimal Stimulation	→	Slowed Nueral Functioning	→	Analgesic Twilight
Absence of Stimulation	→	Sensory Deprivation	→	Disorientation

Figure 2-2. Human Psychological State Movements

influence that will offer a method of escape from the present environment. To sum, "recent stress" plus "a way out" overcomes the restraining effect of habit, conditioning, and military training (5: 26).

Once the zone of "Heightened Suggestibility" is passed, all grip on reality vanishes and the subconscious may take over (i.e., self-protective behavior, hiding, fleeing) or aggression without regard to the odds or danger may be the usual behavior (i.e., berserk, amok). No ability to think logically exists and, thus, appeals are of no use. Therefore, the timing of PSYOP appeals is critical. If too early, there is no motivation to respond; if too late, there is no rational reaction or comprehension; if at the right time, he may respond with the desired reaction (5: 27-8).

Bairdain and Bairdain also proposed five major assumptions as important in the general theory and any derivations of that theory:

1. The history of the targeted individual's experience over the preceding 2 year period is important in creating attitudes positive or negative for defection; the last month previous to finding himself in a pressure situation in which he receives PSYOP appeals is crucial.

2. The absence or presence and, if existing, the degree of external pressure is a major element of how well received a PSYOP appeal is found.

3. The timing of receipt of PSYOP appeals is a determining factor for receptivity to appeals, especially when high external pressures exist.

4. The internal psychological state of the individual is the dominant factor for receptivity to PSYOP appeals under all conditions.

5. The appropriateness of the PSYOP recommended action is significant (5: 62).

This implies that not all PSYOP can be measured for effectiveness. Some PSYOI can always be measured; some can be measured in some circumstances but not in all; and some can never be measured with a reasonable amount of effort, time, and expense. For example, the effectiveness of appeals to a surrounded enemy unit can easily be measured.

I will, therefore, concentrate on psychological operations with surrender as its goal. This data can be relatively easily collected (given a war). I will determine the significant factors which influence a soldier to surrender. Attempting to measure the increase in unit dissension (prior to

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actual surrender) is not reasonable and has not been quantified. Surrender, on the other hand, can be readily determined and factors which influenced the surrender identified.

2.4 PSYOP Effectiveness in Practice

In 1950, the U.S. Army commissioned the Johns Hopkins University Operations Re.earch Office (JHUORO) to produce a technical report on the influence of PSYOP on enemy troops (31). One of the listed goals of the study was, "determine the effect of current PSYOP, particularly leaflets, on the enemy (31: 1)." During a 3 month period at the beginning of 1951, 1006 interviews were conducted with enemy prisoners in Korea, 768 with North Korean and 238 with Chinese. The measure of effectiveness used was the extent to which leaflets produced surrender.

Unless an enemy soldier is physically seized prior to being able to resist, all prisoners surrender to an extent. At some point, they choose to give up rather than face death. How do you draw the line? In Mechanics of Surrender, Capture, and Desertion, the author, Martin Herz, placed soldiers who had been captured into 4 categories (Herz: 392-4). The JHUORO study modified his categories slightly and came up with a 4 point continuum. At one end is capture: an individual gives up because the only alternative is being killed. Next is permissive capture: a man who gives up when he has some chance of escape, even though he is in a dangerous situation. Next is situational surrender: an individual gives up through force of circumstances, such as cold or hunger, but not through a force of arms. Finally, at the other end, is surrender: a man gives up under no immediate threat whatsoever. To provide a clear-cut distinction, only the 2 extreme categories of surrender (28% of the interviewees) and capture (51%) were used (31: ii-iii).

Herz made another distinction in considering capture-surrender behavior (31: 393): Was the individual in an operating unit when he became a prisoner? During the Korean War, a large number (60%) were wanderers who had been cut off or left their units. These were further classified as:
1. Isolatees: Soldiers cut off from their unit, but trying to return.

2. Refugees: Soldiers cut off from their unit, but trying to return home, usually in civilian clothes.

3. Deserters: Soldiers who left their unit by conscious will.

Prisoners taken from operating units were classified as combatants. Combatants composed about 40% of the prisoner population (31: iii-iv).

First, I will consider only the North Korean soldiers. Among combatants, isolatees, refugees, and deserters, more than half were captured. Combat surrenderees constituted only about 10% of the prisoner population.

	Combatant	Isolatee	Refugee	Deserter	Total
Capture	18%	13%	10%	10%	51%
Permissive Capture	7	1	>0.5	1	9
Situational Surrender	2	4	3	2	11
Surrender	11	4	8	6	29
Total:	38%	22%	21%	19%	100%

Table 2-1. Prisoner Breakdown

The military condition of the enemy army was significant. Among prisoners taken from the routed North Korean army (of post-Inchon), there were 3 surrenders for every 4 captures. Later (after the Chinese intervention), the going army had 1 surrender for every 3 captures (31: iv).

	From a Routed Army	From a Going Army
Combatant-Capture	12%	21%
Combatant-Surrender	10	14
Isolatee-Capture	7	20
Isolatee-Surrender	7	-
Refugee-Capture	14	7
Refugee-Surrender	12	1
Deserter-Capture	13	7
Deserter-Surrender	8	5
Others	17	25
Total 100% =	366 Prisoners	301 Prisoners

Table 2-2. Routed vs. Going Army Behaviors
as a Percentage of Prisoner Population

	Routed Army	Going Army
Capture	47%	55%
Permissive Capture	5	14
Situational Surrender	12	11
Surrender	36	20
Total 100% =	380 Prisoners	305 Prisoners

Table 2-3. Routed vs. Going Army Behavior
as a Percentage of Prisoner Population

The enemy's expectation of what would happen to them in prisoner of war camps also influenced surrenders. Prisoners who thought they would be killed almost never surrendered; 59% of prisoners from the going army thought they would be killed. Only 23% of the routed army soldiers thought they would be killed (31: iv-v).

	Routed Army	Going Army
Expected death	26%	59%
Not expected death	23	13
Mixed Expectations	8	6
Expected good treatment	38	21
Total 100% =	380 Prisoners	305 Prisoners

Table 2-4. Post-Prisoner Expectations
as a Percentage of Prisoner Population

The fear of being killed acted as a strong deterrent to surrender. However, the converse was not true. The belief in good treatment did not necessarily lead to surrender. It is clear that in order to induce them to surrender, you must first convince them they will not be killed (31: 29-31).

	Expected Death		Expected More Favorable	
	Routed Army	Going Army	Routed Army	Going Army
Capture	78%	77%	32%	20%
Permissive Capture	6	14	3	13
Situational Surrender	9	7	13	17
Surrender	7	2	52	50
Total 100% =	100	180	230	104

Table 2-5. Routed vs. Going Army Post-Prisoner Expectations
as a Percentage of Prisoner Population

As expected, officers and noncommissioned officers surrendered less readily than privates. Likely, the officers and NCO's were chosen for their political reliability (31: v).

Inexperienced soldiers (less than 4 months of service) were more likely to surrender than experienced troops of the going army. Under a routed army, both surrendered in equal numbers (31: v).

Age, education, marital status, place of residence, civilian occupation, length of training, and literacy did not affect capture-surrender behavior (31: v).

Since leaflets may are used in conjunction with other influences to surrender, it is possible that other influences alone would have been enough (without the leaflets) to cause surrender. To determine this, the researchers had to consider the following question: "Did those who did not see leaflets still surrender, because of the influence of the other factors, as readily as those who had seen the leaflets?" Data showed the leaflets did have a significant effect.

Among North Korean soldiers who saw the leaflets (47%), there were 4 surrenders for every 5 captures. For those North Korean soldiers who did not see the leaflets (53%), there were only 2 surrenders for every 5 captures (31). Similarly, among Chinese Communist soldiers who saw the leaflets, there were 6 surrenders for every 7 captures (30). For those Chinese Communist soldiers who did not see the leaflets (53%), there was only 1 surrender for every 20 captures (30: 49). Leaflets were effective in both the routed and going army. While it would be inappropriate to infer that leaflets alone caused this huge increase in surrenders, it is clear that leaflets were a significant factor. After exposure to leaflets, the surrender rate increased (31: 58-61).

A little more than one-third of the surrenders took place within 1-2 days of seeing a leaflet and nearly 3 in 5 occurred within 1 week. Only 8% reported surrendering more than 30 days after seeing a leaflet (31: 80-1). Leaflets must be used frequently to maintain any influence on behavior.

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	Surrender to Capture Ratio
North Korean Soldiers:	
Saw Leaflets	4/5
Did Not See Leaflets	2/5
Chinese Communist Soldiers:	
Saw Leaflets	6/7
Did Not See Leaflets	1/20

Table 2-6. Leaflet Influence on Surrenders Based on Prisoner Population

1 - 2 days	34%
3 - 7 days	24
8 - 14 days	9
15 - 30 days	17
More than 30 days	8
Do not remember	8

Table 2-7. Lapse of Time Between Seeing Leaflet and Surrendering

Taken as a whole, prisoners reported that the following factors influenced their surrender:

1. Persuasion of villagers (only for the North Korean Army)

2. Leaflets

3. Persuasion of fellow soldiers

4. Separation from their unit; no alternative available

5. Dislike of the military

6. Disaffection with their military leadership

7. Loudspeakers and radio broadcasts

2.5 PSYOP in the Corps Battle Simulation (CBS)

The Corps Battle Simulation, formerly known as the Joint Exercise Support System (JESS), is the corps/division command and staff trainer in the Army's Family of Simulations. It is used primarily as a command post exercise driver and is used by the Battle Command Training Program to train corps, division, and brigade staffs (20: cbs.txt).

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Beginning in 1991, the Army Chief of Staff directed at special operations force (SOF) operations be integrated into all BCTP rotations. An integration plan was developed with the following objectives:

1. Develop the methods of play for SOF within the current simulation model.
2. Recommend improvements to the current CBS model to enhance the capabilities to realistically portray SOF.
3. Develop the required SOF database information.
4. Develop observer-controller (OC) checklists.
5. Develop after action review (AAR) topics and products.
6. Determine the personnel (military and contractor) and equipment requirements for SOF support of BCTP rotations (12).

Because BCTP focuses mainly on the tactical level of warfare, the integration of PSYOP concentrated on the capabilities that will most enhance the conventional corps and division commanders' execution of their assigned mission using current U.S. Army doctrine. BCTP deals primarily with tactical PSYOP (see section 2.1). PSYOP's major role was seen by the integration team as " .. a major weapon in the politico-military struggle by helping insure that non-combat activities don't become more decisive in war than combat operations (12: 18)." The following missions were modeled:

1. Leaflet drops
2. Assistance with deception operations
3. Loudspeaker missions

Leaflet drops are modeled in the following manner. The initial leaflet campaign(s) must be planned and approved prior to the start of the game. Follow-on leaflet drops can be planned and executed at any other time during the exercise. Leaflets are dropped into specific drop areas and results determined using the PSYOP Attrition Matrix (see table 2-8) once enemy units have been identified in the leaflet zone (12: 18).

A	Unit Identification	unit ID of enemy unit encountering leaflets (from enemy side data)
B	Unit Strength	from enemy side data
C	% Attrition	roll of dice to determine % loss
D	# Attrition	$B \cdot C$
G	Risk Assessment	Based on enemy density and distance to nearest blue unit
H	% Prisoners	% of D who become prisoners (based on risk)
I	# Prisoners	$D \cdot H$
J	Unit Location	6 digit grid coordinate at the time of initial attrition

Table 2-8. CBS PSYOP Leaflet Attrition Matrix

Attrition occurs in the following sequence:

1. As the enemy (white side) unit enters the leaflet dispersion area, the SOF controllers identify the unit and its current strength.

2. The senior controller attrits the enemy unit based on a roll of the dice to determine % attrition times the unit strength.

3. The SOF controller determines the time and distance to the nearest friendly (blue side) unit. Based on this and a measure of the white unit density, the number of defectors actually reaching that blue unit is determined. At the appropriate time a message is sent to that blue unit concerning the defectors surrendering to them.

4. Upon contact with the blue unit, the SOF cell transfers a blue DEFECTOR icon to the appropriate maneuver white side unit. Prisoners are not modeled in CBS. Because of this, any surrenders are treated as defectors.

5. A report is sent to the white side indicating that defectors are carrying leaflets (which specific leaflet), the unit the defector is from, the location of the unit at the time of desertion, and the status of the unit at that time (12: 19).

For PSYOP in support of deception operations, the following sequence is used:

1. The SOF controller constructs the deception icons (after coordinating with the senior controller and in accordance with the appropriate operations order or operations plan).

2. If either side (white or blue) reacts to the deception icons, the results are considered observable (12: 20).

The effects of loudspeaker operations is played similar to leaflet operations, both for the white and blue sides (12: 20).

While this approach does include PSYOP as another combat support asset available to the maneuver commander, it also includes a few unrealistic assumptions. Namely,

1. All PSYOP products are equally effective. Because attrition is determined only based on a roll of the dice, each PSYOP product has the same chance of compelling surrenders.

2. All PSYOP targets are equally vulnerable to the PSYOP themes and messages. Again, each unit's vulnerability, regardless of the differing morale, leadership, and other significant factors, is uniform.

3. PSYOP assets are always available. There is no mechanism to verify that both personnel and equipment/material is sufficient for the development and production of the PSYOP product.

2.6 Summary

This chapter summarized the literature in several key areas that build the foundation for the methodologies in Chapter 3. In particular, the current doctrine forms the fundamental basis for much of the development of the task list to prototype. The discussion on PSYOP effectiveness theories points to possible approaches that may be of use in modeling PSYOP processes. The section on PSYOP effectiveness in practice provides a framework to begin turning the doctrine and tactics into a structure that can be applied to JTLS. Finally, a brief description of how PSYOP is modeled in CBS presented the only approach to date for including PSYOP in DoD simulation models. The next chapter integrates these several concepts into the overall methodology for my research.

III. Model Methodology

This chapter describes the methods used in this research. Section 3.1 outlines how I gained the subject matter background required to conduct this thesis. Section 3.1.1 discusses the development of my final task list of tasks to prototype. Section 3.2 summarizes the evolution of the prototypes. Finally, section 3.3 covers validation and review issues.

3.1 Knowledge Acquisition

The U.S. Army's psychological operations doctrine is presented in FM 33-1, "Psychological Operations." Because it was recently updated in 1991-92, it represents the most current tactics and procedures in the Department of Defense. It also represents the only approved source of PSYOP doctrine; there is no other source of published PSYOP doctrine.

Any prototype developed should be based on current, accepted, and approved doctrine. I restricted my knowledge acquisition to FM 33-1 for this reason. During the knowledge acquisition phase, I transferred the tactical knowledge contained in FM 33-1 and organized it into a usable form.

3.1.1 Task List Development.

Figures 3-1 and 3-2 includes some examples of PSYOP support. For ease of viewing, these figures are broken into 2 distinct groups: PSYOP in support of low intensity conflict operations and peacetime and PSYOP in support of conflict and war. These figures list more than 90 examples of PSYOP support across 13 different portions of the operational continuum (see figure 2-1). This listing is not exhaustive by any measure. However, closer analysis does reveal

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Peacekeeping Operations	Foreign Internal Defense	Contingency Operations	Terrorism Counteraction

• Develop PSYOP products designed to maintain the consent of the local populace and belligerents concerning the presence of a peacekeeping force.
 	
• Project neutral image of the force as an uncommitted, nonaligned third party between hostile parties.
 	
• Develop, coordinate, and conduct
  – Information and education programs.
  – Peacekeeping operations training for the forces of other nations involved in the mission.
  – Allied points of contact between all parties involved.
  – Area assessment to identify key leaders, key groups, and local sensitivities, and susceptibilities.
	FID
	• Integrate PSYOP into all aspects of the foreign assistance programs, including internal development, humanitarian aid, and security assistance.
	
	• Develop campaigns to inform international community of U.S. intent and goodwill.
	
	COUNTERINSURGENCY
	• Assist the HN government in gaining the support of its people.
	
	• Assist the HN government in defeating the insurgents by shifting the loyalty of opposing forces and their supporters to friendly control.
	
	• Project a favorable U.S. image in the HN.
	
	• Develop products to influence neutral groups and the world community favorably.
	
	• Assist the HN in establishing defector rehabilitation programs.
	
	• Provide close and continuous PSYOP support to maximize the effect of civil-military operations.
	
	• Establish HN command support of positive population control and protection from insurgent activities.
	
	• Provide area assessment.
	
	INSURGENCY
	• Provide area assessment.
	
	• Create popular support for the resistance movement.
	
	• Develop passive support of the populace to allow insurgents to avoid detection and move freely.
	
	• Develop programs to gain converts and recruits for the resistance's political, military, and intelligence infrastructure.
	
	• Develop PSYOP products to popularize the anticipated reforms and programs to benefit the audience once the hostile government is overthrown.
	
	• Develop programs to inform world community of U.S. intent and goodwill.
		• Explain the purpose of the U.S. contingency action to counter disinformation.
		
		• Assist in establishing control of noncombatants, neutrals, and other groups in the area of operations to help minimize casualties and to prevent interference with friendly operations.
		
		• Prevent or deter interference by hostile forces or other nations in the contingency operation.
		
		• Provide continuing analyses of political and cultural factors to help maximize political and psychological effects of the operation.
		
		• Provide PSYOP support to noncombatant evacuation operations.
		
		• Minimize interference of indigenous populations.
		
		• Exploit withdrawal of U.S. forces while creating positive perceptions of U.S. intent and goodwill.
			• Counter the adverse effects of a terrorist act.
			
			• Inform the target audience of the terrorists' goals, leaders, and infrastructure.
			
			• Provide incentives to local populace to inform on terrorist groups.
			
			• Develop programs targeted at terrorist groups to persuade them that they cannot achieve their aims through terrorist activities, that they are at great personal risk, and that responsible governments will not negotiate with them under terrorist conditions.
			
			• Divide and undermine terrorists' support structure.

Figure 3-1. PSYOP In Support of Low Intensity Conflict Operations and in Peace

Strategic Level	Operational Level	Tactical Level
• Project a favorable image of the United States.	**DEEP OPERATIONS**	**DEEP OPERATIONS**
• Support allies and other U.S. agencies in efforts to prevent war and assist in the resolution of a crisis without resorting to war.	• Publicize and exploit harsh opponent population control measures and racial, ethnic, and religious practices.	• Create a favorable image of U.S. and allied soldiers' good treatment of EPWs.
• Assess opponent propaganda directed against U.S. targets, measure its effectiveness, and develop counterpropaganda.	• Encourage disaffection of opposing force civilian population.	• Discourage and disrupt opponent operations by spreading doubt, discontent, and distrust among opponent personnel in the targeted area.
• Prepare target population for introduction of U.S. forces into its country.	• Build or create political and military alliance unity or disunity.	• Support strategic PSYOP by furnishing detailed and timely information of local susceptibilities up the chain of command.
• Design PSYOP programs to explain U.S. policies to friendly and neutral audiences and to gain their acceptance of U.S. policies.	• Stimulate support of opposition elements within the opposing force or government.	• Assist in tactical cover and deceptions operations.
• Design PSYOP efforts to minimize friendly, neutral, or hostile civilian population interference with U.S. deployment operations.	• Undermine confidence in opponent leadership and war aims.	• Induce surrender.
• Convince the target the U.S. can fulfill its aspirations.	• Create concern about the futility of war.	• Produce "Free Pass" leaflets and coordinate with friendly commands to ensure leaflets are honored.
• Publicize and exploit opponent racial, ethnic, and religious prejudices and intolerances.	• Support resistance activities.	• Design programs of psychological actions that are amplified by psychological products.
• Exploit opponent support of terrorist groups and activities.	• Advertise program successes to friendly, neutral, and hostile audiences.	
	• Encourage disaffection of opposing troops.	
	• Provide support to deception operations.	
	• Support linkup with unconventional warfare element.	
	CLOSE OPERATIONS	**CLOSE OPERATIONS**
	• Integrate PSYOP with battlefield maneuver plans.	• Assist in tactical cover and deception operations.
	• Provide area assessment; assess psychological effect of friendly operations.	• Help control civilians in the combat area.
	• Explain U.S. policies to friendly and neutral audiences to gain their acceptance of U.S. policies or intended action.	• Give information and directions to isolated friendly elements operating in the combat zone.
	• Conduct counterpropaganda programs.	• Discourage and disrupt operations by spreading doubt, discontent, and distrust among opponent personnel.
	• Capitalize on defeats.	• Lower enemy morale and efficiency by emphasizing friendly successes and the futility of dying.
	• Encourage disaffection of troops.	• Emphasize danger to opponent of working in NBC environment.
	• Conduct surrender appeals, synchronized with battle success.	• Provide "Free Pass" leaflets.
	• Assist in battlefield control of displaced persons and refugees.	• Facilitate the occupation of opponent towns by delivering ultimatums and giving directions for ceasing hostilities.
	• Interrogate prisoners of war.	• Publicize civilian control measures by using broadcasts and printed information.
	• Provide support to tactical deception operations.	
	REAR OPERATIONS	**REAR OPERATIONS**
	• Assist MPPW/COM in prisoner-of-war camps.	• Provide area assessment to identify key leaders and local sensitivities.
	• Develop HN contacts for language specialists and equipment usage.	• Create a favorable image of U.S. and allied soldiers and leaders to local populace.
	• Conduct PSYOP to counter effects of hostile terrorist, sabotage, or special purpose force activities.	• Counter hostile propaganda by initiating a well-planned, aggressive, and effective PSYOP program.
	• Assist in control of displaced persons and refugees.	• Publicize civilian control measures by using broadcasts and printed information.
	• Conduct counterpropaganda programs.	• Help control enemy and civilians in the combat area.
	• Support civil-military operations.	• Use local nationals and interpreters to establish effective communications nets and intelligence sources within rear area.

Figure 3-2. PSYOP in Conflict and War

the most common trends in PSYOP support. I used these generalizations as the basis for developing an initial listing of PSYOP tasks to prototype for inclusion in JTLS.

First, I organized a generic task statement: "Use media type to support type operation by purpose." There are many specific media types (i.e., posters, leaflets, video, radio, loudspeaker, etc.), however, these can be grouped into three general categories: printed materials, loudspeakers, and radio/television. I chose these same categories as the media types I would prototype. These media types can be used to support the following operations:

1. consolidation operations
2. special operations: direct action
3. special operations: special reconnaissance
4. special operations: foreign internal defense
5. special operations: counterterrorism
6. conventional operations: defensive
7. conventional operations: offensive
8. contingency operations: disaster assistance
9. contingency operations: noncombatant evacuation
10. contingency operations: security assistance surges

These were chosen because all represent missions capable of being played within the current JTLS structure. Lastly, and most importantly, what purpose did these PSYOP efforts serve? I narrowed down the following purposes:

1. increase local population support by making U.S. or host nation intentions known, disseminating information, or discrediting the enemy
2. find supply caches and enemy personnel
3. separate combatants and noncombatants
4. limit the negative effects of a friendly or enemy action
5. demoralize the enemy and urge surrenders

Appendix B contains the complete listing of tasks to be prototyped. Any task not on this listing was either unable to be represented by JTLS or could be replicated with one of the tasks from my final listing. For example, see figure 3-1 under "Foreign Internal Defense: Counterinsurgency." One of the examples is "Assist the [host nation] government in defeating the

insurgents by shifting the loyalty of opposing forces and their supporters to friendly control." This can be substituted with my task, "Use media type to support foreign internal defense by making host nation intentions known." There were some tasks that could not be replicated. Figure 3-2. Close Operations listed "Integrate PSYOP with battlefield maneuver plans." Clearly, this has to occur outside of the game structure. It is a desired outcome of the whole JTLS conflict model -- better trained and knowledgeable staffs and commanders. I saw no need to replicate 92 separate tasks when a smaller number could serve the purposes and intentions just as well.

As a form of expert review, I had my initial task list examined by the U.S. Special Operations Command senior staff officer for PSYOP, the Directorate of Psychological Operations and Civil Affairs. Further, my task list was reviewed by the 4th Psychological Operations Group. the only active duty PSYOP unit in the U.S. Army. Finally, the school which teaches U.S. PSYOP doctrine and tactics to future PSYOP staff officers and commanders, the Psychological Operations Officer's Course of the Special Warfare Center, reviewed my listing.

I received the best feedback from the Directorate of Psychological Operations and Civil Affairs, COL Harold W. Youmans. He stated "Your efforts thus far are surely on track (39)." He recommended that I include tasks to model PSYOP support of strategic objectives. These include:

1. Provide recommendations to US Government and military planners in the use of military PSYOP in National Strategic Programs.

2. Support execution of the Overt Peacetime PSYOP Program (OP3).

3. Provide PSYOP support in conjunction with US public diplomacy initiatives.

While these activities are important, I felt they fell outside the scope of scenario JTLS plays. For example, OP3 is directed at foreign populations with diplomacy as its principal effect. The objective might be to preclude hostilities with an implied mission of establishing favorable conditions if war occurs. This all falls outside the normal JTLS scenario boundaries (17: C-1 -- C-5).

He also recommended that I include prisoner of war operations. Again, this is outside of current JTLS capabilities. JTLS currently does not model prisoners of war or captured enemy (or friendly).

3.1.2 PSYOP Effects.

There is a severe lack of current data concerning the effectiveness of PSYOP. The only available data is from a series of studies conducted dur n_c the Korean War for the Army by the Johns Hopkins University Operations Research Office. Because of this, two specific limitations immediately present themselves:

1. Any implications made as a result of this study must be balanced with the fact that all data is from one specific conflict occurring over 40 years ago.

2. Because of the very nature of the capture-surrender behavior, all data encountered was already censored. That is, a significant portion of the true enemy population was left out of the data collection. Since only living prisoners were interviewed, no data was collected on the attitudes of those soldiers who were killed, who successfully deserted and returned to their home villages. Only soldiers who were in U.N. control were interviewed.

Additionally, I relied on a recent study performed by Computer Services Corporation (CSC) for USSOCOM. The study was conducted between January and November 1992 to examine the effects that civil affairs (CA) and psychological operations have on conflict operations. Its objectives included:

1. Define mission/tasks for simulation.

2. Review current conflict models for feasibility of simulating CA and PSYOP processes and effects.

3. Review historical data for impact of CA and PSYOP effects on conflict processes.

4. Quantify CA and PSYOP effects and define generic routines and algorithms to simulate these effects into recommended models and simulations.

5. Develop a methodology that would incorporate CA and PSYOP processes and effects into those current models and simulations best suited to reflect the impact of CA and PSYOP activities within the combat context.

In this study, CSC laid out a basic framework for representing what they referred to as "combat-enabling" processes, extra-combat processes that provide the basis within which combat functions are prosecuted. Combat-enabling processes also provide the support that allows combat processes to be continued past initiation of hostilities (11: 1). PSYOP is a combat-enabling process.

3.2 Prototype Construction

The development of the prototypes is represented by Figure 3-3. The actual prototypes are a set of flowcharts and psuedocode (see Appendix C). The flowchart and psuedocode format offers distinct advantages. JTLS currently uses both types in the JTLS Analyst's Guide and this forms a basis for its code writers. The flowcharts also aid in verifying the rule structure for completeness. Finally, a picture (i.e., flowchart) is a readily understood format for peer and expert review.

All of PSYOP tasks I chose to prototype follow a similar overall structure. First, PSYOP planners must determine what themes to use and which audience(s) to target, based on the current situation, political climate, and a host of other factors. The focal point of this PSYOP analysis process is the target audience analysis. In doctrine, target audience analysis (TAA) is defined as the process by which potential target audiences are identified and analyzed for effectiveness,

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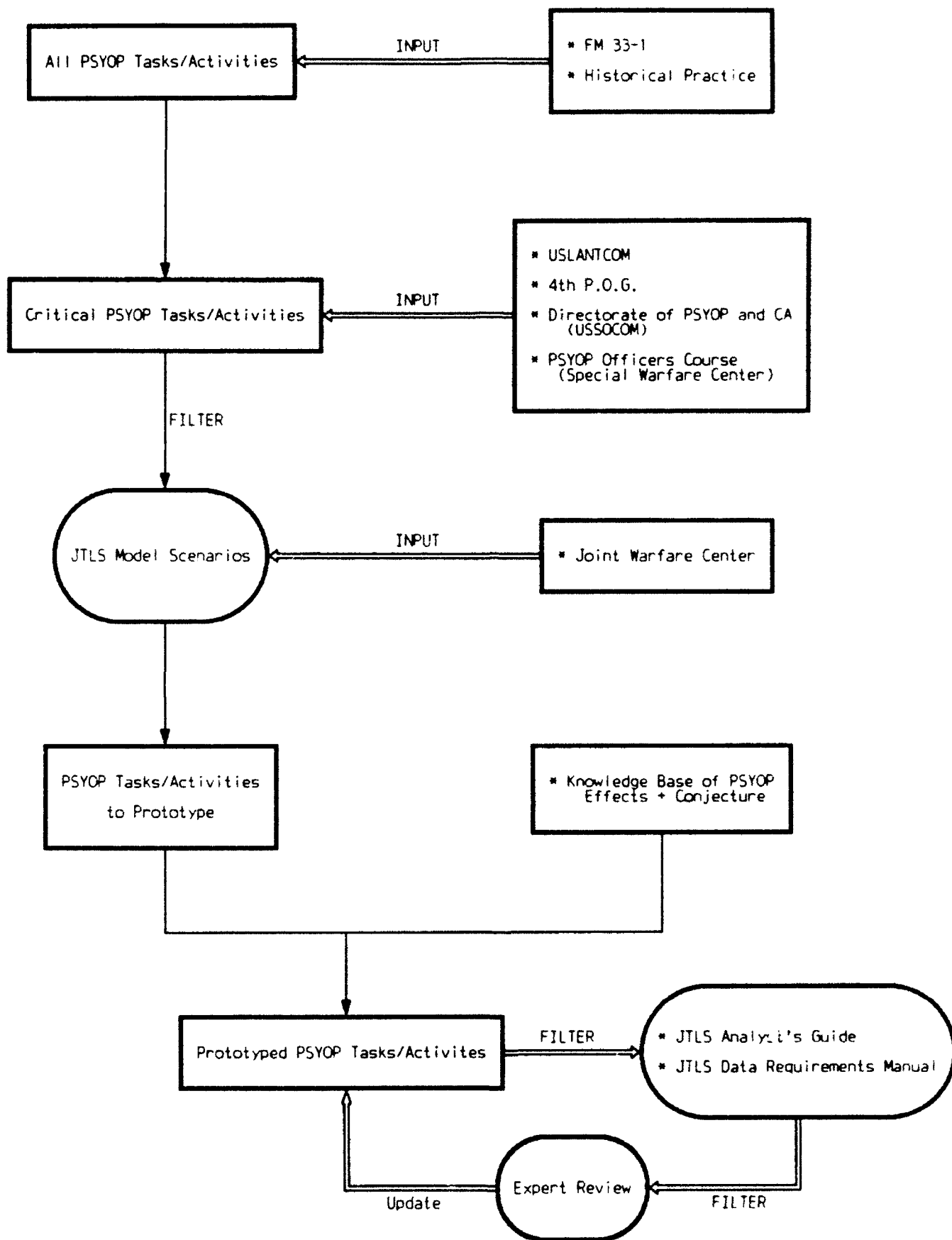
Figure 3-3. Prototype Development

accessibility, and susceptibility (17: Glossary-14). While it is one of the most important elements of a successful PSYOP campaign, it may also be one of the most difficult to represent. I wanted to show that TAA is a continuous process. It must be anticipated and planned for, similar to ammunition resupply considerations for infantry troops.

Next, the PSYOP product must be developed and produced. In other words, the themes and target audience decided during the PSYOP analysis process must be realized through some type of medium (i.e., "safe conduct" passes to be delivered by airdrop). Recall, PSYOP products are defined as "any visual, audio, or audiovisual item generated and disseminated in support of a PSYOP program (17: Glossary-11)." Product development and production normally also includes media selection: audio, visual, or print. I have assumed that appropriate media selection has occurred as part of the development. I did not explicitly model the media selection sub-process. The actual physical production (i.e., printing, recording, etc.) is conducted during product production. The CSC study recommends that three separate production processes be modeled: audio, video, and printed products. Each of these would require different resources and times to complete. This production then uses resources that must be resupplied through the in-place JTLS logistics system. Post-production, the product becomes an asset of the unit that produced it. It does, however, have a "shelf life" because PSYOP products designed for one set of circumstances do not apply with equal effectiveness to another and a PSYOP campaign designed now may not be effective two weeks from now due to changes in the political, economic, cultural, or religious environments.

Then, the product must be distributed to the intended audience. Product dissemination will involve both PSYOP-unit organic assets (loudspeakers, radio broadcasts) and non-organic assets (aircraft, artillery). Products will be shipped, if necessary, to supporting units using existing JTLS logistics system. Delivery assets must be available and capable of performing the mission assigned.

Finally, the effects (if any) of that PSYOP mission must be modeled and the JTLS model structure changed to represent these effects on the other combat processes. PSYOP effects will be

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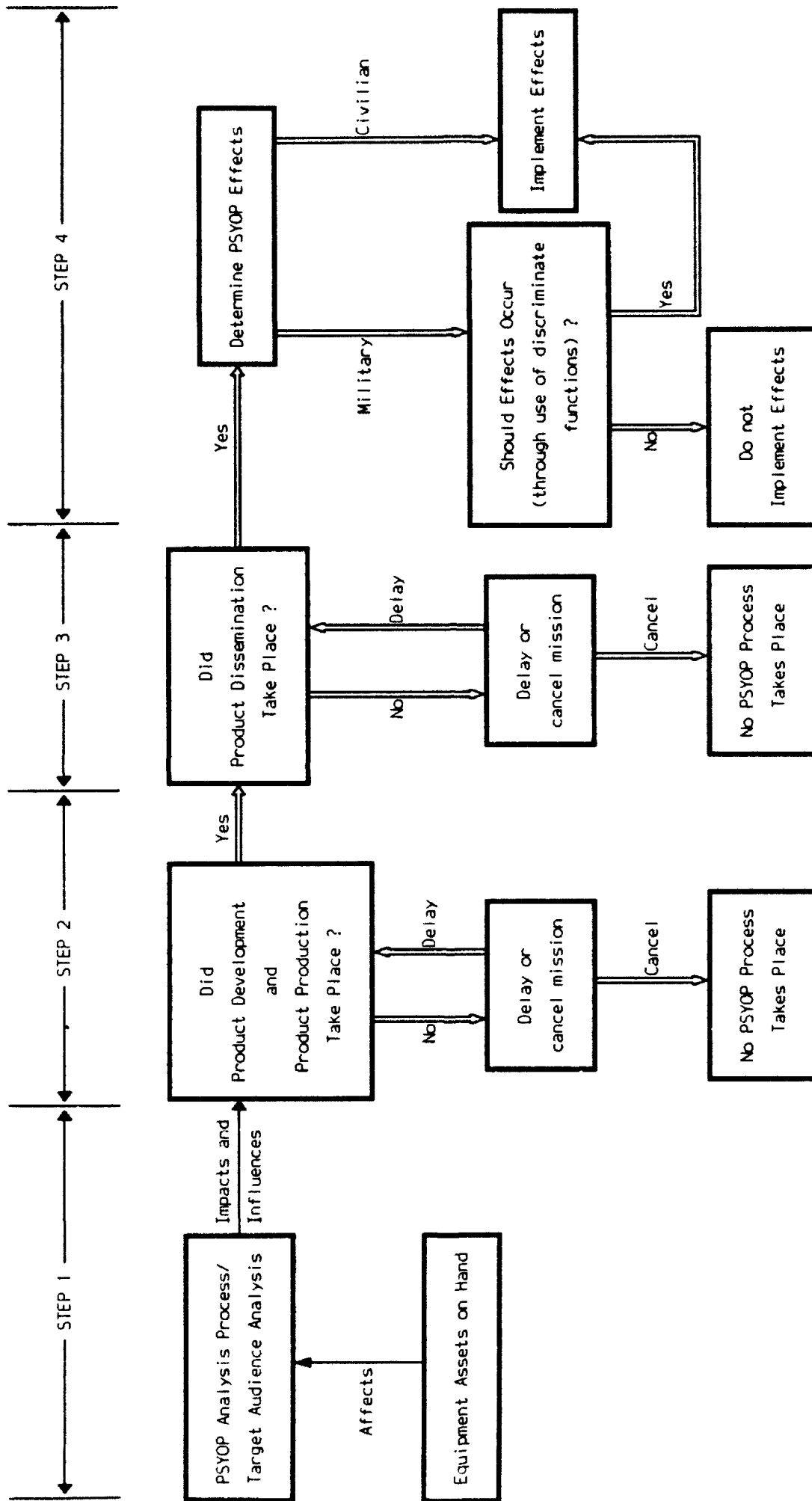
Figure 3-4. Overall Prototype Scheme

modeled differently with respect to the target type: civilian or military. Military targets are further sub-divided into armies fighting in their homeland and armies fighting on foreign soil. A discriminate function (based on the Korean War data) will determine if the unit is more likely to surrender or not surrender. Civilian targets are handled differently. No actual combat events are assumed to occur between U.S. forces and host nation civilians. Because there is absolutely no data available concerning the effect of PSYOP on civilians, an explicit representation of effects is not possible. Effects will be aggregated and an adjustment will be made to the effectiveness of units operating within the "PSYOP-ed" civilian population.

Figure 3-4 shows my overall scheme for prototyping PSYOP processes. The quality of the PSYOP analysis process (a function of when the analysis process was last updated) will influence the time it takes to develop the PSYOP product. If product production and dissemination have occurred, then PSYOP effects (if any) are determined. Table 3-1 shows the current status of JTLS and the objectives of this research in terms of the 4 step process outlined earlier.

Objective	Current Status	Prototype Goal
Target Audience Analysis Process	Not represented	Implicitly represented as a continuous process
Product Development and Production Process	Not represented	Explicitly represented; media selection assumed
Product Dissemination	Analogous to Resupply Operations	Incorporate PSYOP products into existing structure
PSYOP Effects on Soldiers	Not represented	Quantify an Estimate of PSYOP's Effects on Enemy Troops
PSYOP Effects on Civilians	Not represented	Model Aggregate Effects on Civilians

Table 3-1. Comparison of Current Model Status and Research Goals

During the 1988 Winter Simulation Conference. Robert Sargent presented his paper. "A Tutorial on Validation and Verification of Simulation Models." In it. he defined validation as "the substantiation that a computerized model within its domain of applicability possesses a satisfactory range of accuracy consistent with the intended application of the model (37: 33)." Verification was defined as "ensuring that the computer program of the computerized model (i.e.. the simulator) and its implementation are correct (37: 33)."

He defines conceptual model validity as "determining that the theories and assumptions underlying the conceptual model are correct and that the model representation of the problem entity is 'reasonable' for the intended use of the model (37: 33)." He goes on to outline 15 different validation techniques specific to simulation models:

1. Animation (Operational Graphics)
2. Comparison to Other Models
3. Degenerate Tests
4. Event Validity
5. Extreme-Condition Tests
6. Face Validity
7. Fixed Values
8. Historical Data Validation
9. Historical Methods: Rationalism. Empiricism. Positive Economics
10. Internal Validity
11. Multistage Validation
12. Parameter Variability - Sensitivity Analysis
13. Predictive Validation
14. Traces
15. Turing Tests

Of these 15, only one appears to be an appropriate approach to validating the PSYOP prototype presented here. This technique. face validity. is described by Sargent as "... asking people knowledgeable about the system whether the model and/or its behavior is reasonable. This

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technique can be used in determining if the logic in the model flow-chart is correct and if a model's input-output relationships are reasonable (37: 34)." This is also commonly referred to as expert review.

The other techniques do not appear to apply to my methodology because of the absence of other PSYOP modeling efforts, the nature of the JTLS combat model, and the nature of my prototyping efforts. Because this research is the first effort at integrating the quantitative effects of PSYOP into a combat simulation, there are no other models (or even processes) to compare it to. Because no detailed PSYOP effectiveness data has been collected for over 40 years, event validity and fixed values cannot be employed as validation techniques. Again, due to this lack of data, none of the three historical methods may be used. These would require that my model predict the future -- this is obviously not JTLS's purpose. JTLS is used as a training tool, not an analysis tool.

However, some of these techniques should be used once subsequent coding is complete. Degenerate tests, extreme-condition tests, fixed values, parameter variability-sensitivity analysis, and traces can all be used to validate the final code. My research, though, will only use face validity.

Face validity of the prototype took place at several levels -- initially, peer review and, later, expert review. Both reviews looked at the face validity of the prototypes. The results of the validation were either directly incorporated into the rules or noted in the summary and recommendations as unresolved issues.

The Directorate for Psychological Operations and Civil Affairs of USSOCOM, the 4th POG, and the Psychological Operations Officer's Course of the Special Warfare Center provided expert review for the prototypes. They reviewed the rules for doctrinal correctness. The Joint Warfare Center review the prototypes for compatibility with proposed changes to the JTLS model.

3.4 Summary

This chapter provided the methodology for development of the prototypes. The following chapter presents the results of the research. The actual flowcharts and psuedocode will be provided.

IV. Model Development

4.1 Overview

This chapter discusses the development of the psychological operations task(s) prototypes for use in JTLS. It focuses on an overview of my proposed representation of the target audience analysis (TAA) process, the product development, production, and dissemination process, the determination of PSYOP effectiveness, and any new JTLS initialization actions that must be accomplished to implement my recommendations.

It is not my intent to reproduce current U.S. Army psychological operations doctrine and practices. Rather, the purpose is to provide the necessary background to allow for the development of a set of PSYOP-specific tasks and activities which may be integrated into future versions of JTLS. Appendix C contains the specific prototype descriptions: flowchart and associated psuedocode. Doctrine and existing practices are clearly the driver for any of the prototypes. In Appendix C, each prototype is cross-referenced to either specific doctrine, existing data, or both.

Section 4.2 will detail my methodology for modeling the PSYOP analysis process. Similarly, section 4.3 discusses recommendations for modeling product development, production, and dissemination. Section 4.4 will outline the majority of my research, modeling the effects of PSYOP. Included are detailed descriptions of new JTLS initialization procedures, the development of discriminate functions, the implementation of such functions, the modification of the current JTLS attrition formulas to model appropriate capture-surrender behavior, and a recommendation concerning PSYOP directed against civilian targets.

The PSYOP analysis process is essential to successful PSYOP mission accomplishment. Without a thorough analysis process, the PSYOP mission and, consequently, the supported commander's mission is placed in jeopardy Figure 4-1 shows the PSYOP analysis process.

As shown, the PSYOP analysis process is a continual and cyclical process of both intelligence analysis and evaluation. The process is both systematic and continuous, and is used to analyze and integrate intelligence data on area characteristics. Fundamentally, the process is a modification of the procedures normally performed during the intelligence preparation of the battlefield (IPB). The IPB is also a systematic, continual process to help commanders determine

CONFLICT
ENVIRONMENT

ANALYSIS

SOCIAL &
POLITICAL
ENVIRONMENT

Demographic
Evaluation
and Target
Audience
Analysis

Operational
Area
Evaluation

Geographic
Analysis

Intelligence
Preparation
of the
Battlefield
(IPB)

Climate &
Weather
Analysis

Data Base
Integration

EVALUATION

TECHNICAL ENVIRONMENT
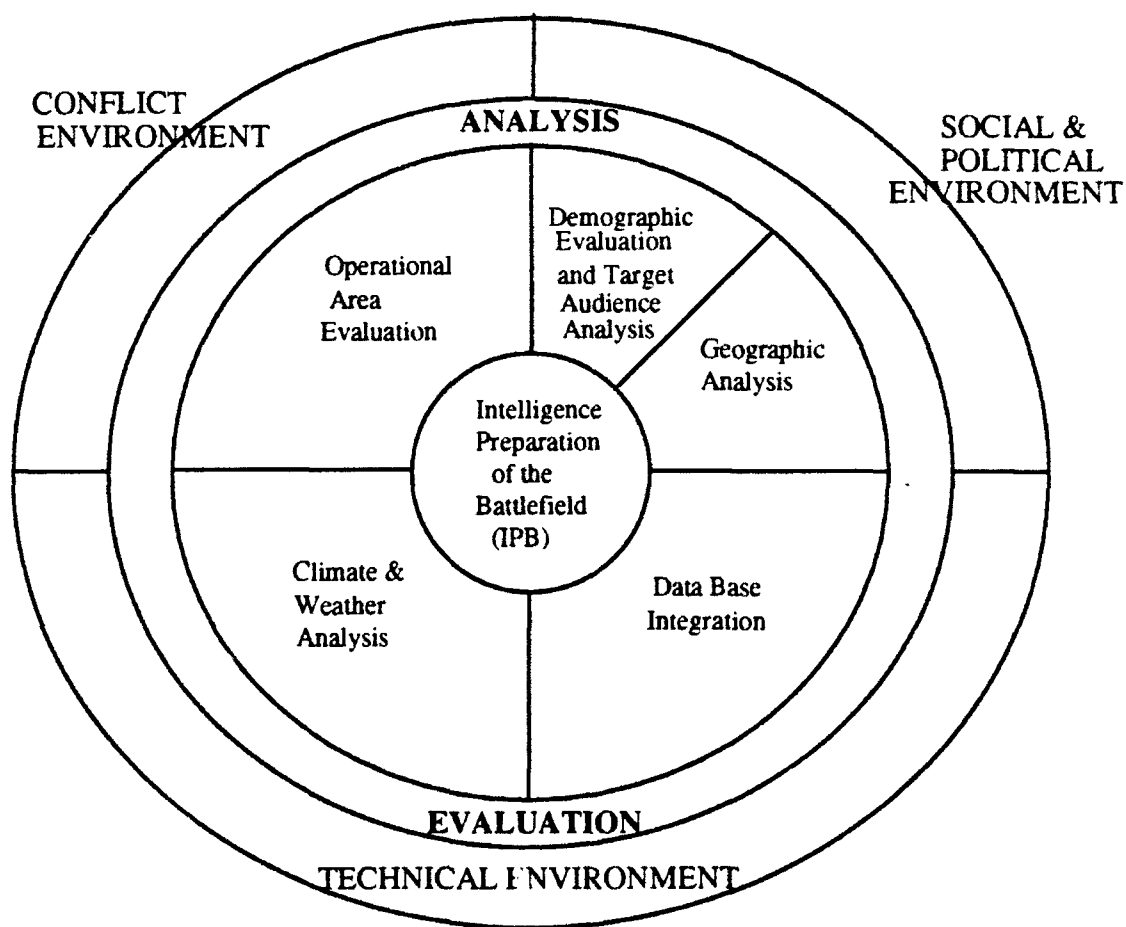
Figure 4-1. The PSYOP Analysis Process

the best courses of action for their operations. The IPB is mainly oriented on terrain through analysis of the threat, the battlefield area, and analysis of the impact of terrain and weather. The PSYOP analysis process, on the other hand, builds on the IPB but is people oriented. The process looks at target audiences both within and outside of the area of operations. During the process, possible target groups, credible leaders, the preferred media for the audience, and possible PSYOP issues are investigated. The weather is analyzed with respect to its effects on PSYOP media and dissemination. This usually involves looking at wind speed, wind direction, seasonal changes, or any other factors that may affect PSYOP planning. Data from this is used to influence timing considerations, dissemination techniques, and media selection. The area's geography is studied to estimate how the culture, population density, and product dissemination are affected. Demographic, social, cultural, economic, political, religious, and historical components are studied. Potential target audiences are examined for vulnerabilities and credible communicators. Also, the enemy's counter propaganda and PSYOP techniques are considered. For example, at the end of a PSYOP analysis process it might be decided to target front-line Iraqi units and stress the themes of Arab brotherhood and that Saddam Hussain is the only reason for hostilities against Iraq (1: 27).

This vast amount of data is integrated into a data base for PSYOP planners. A theme's effect(s) on friendly, opposing, and nonbelligerent third-party actions is examined. Only after examining the effect of a specific theme or action are target audiences recommended. The overall PSYOP analysis process lets PSYOP personnel provide timely, expert advice to their supported commanders (17: 8-5 -- 8-8).

Even though this analysis is not restricted to the pre-conflict, conflict, or post-conflict stage of the combat continuum, there are activities that must be performed during specific stages. As noted in the CSC study, "The analysis performed pre-conflict will determine the starting position (level of effectiveness) for the game's PSYOP elements. The starting level of effectiveness will be modified by the game's dynamics as it is played (11: 3.7.1)." Consider the following:

TEL = Target Audience Analysis Effectiveness Level

TEL represents a rating of the effectiveness of the current PSYOP analysis cycle. Because this must be updated continually, a penalty should be assessed a penalty if this fails to happen. ˙ As time passes, the value of the current PSYOP analysis will fade, due to changes in the social, military, etc. components listed earlier. Each U.S. PSYOP unit will have a TEL value. However, the question remains, "How effective should the initial analysis be?" I saw two choices: assume perfect or imperfect PSYOP analysis initially. Perfect analysis implies that a PSYOP unit with only 50% of its available equipment resources can still perform as thorough an analysis as a 100% capacity unit. This makes no intuitive sense. I have chosen to assume that the equipment assets available to a PSYOP unit have a direct relationship on the effectiveness of that unit's PSYOP analysis.

Players have the responsibility of conducting the initial PSYOP analysis. The TEL should be first computed during game initialization:

$$TEL = \frac{Equipment\_Assets\_on\_hand}{Equipment\_Assets\_Authorized} \cdot 100 \qquad (1)$$

The assets used to determine the TEL are only equipment assets. I have assumed that if a PSYOP unit has the equipment, that unit will use such equipment perfectly. Specifically, capability equals availability. Personnel limitations are explicitly considered later in this research.

This can be relatively easily computed using information already contained in the JTLS database. The COMBAT SYSTEMS array describes the current status of each unit's combat systems. Contained within this array are entries for "Operational Systems Now", "Maximum Number Ever Operational", and "TOE Number," the quantity of the system authorized in the unit's TOE. Substituting these values into equation 1 yields the following:

$$TEL = \frac{\sum_{i=1}^{n} (\frac{Operational\_Systems\_Now_i}{TOE\_Number_i})}{n} \cdot 100 \qquad (2)$$

for   n = Combat System Types

By using the above method, it is assumed that no judgment is made as to whether the assets (personnel, equipment, supplies, etc.) are appropriate for the mission. However, realizing that the TOE of a unit is designed with that unit's mission in mind, this assumption appears valid. It does assume, though, that system type 1, as a class, is equally valuable to the performance of the unit mission as system type 2, as a class. For example, consider a unit with only two combat systems types, M1A1 tanks and TOW anti-tank missiles. I have assumed that M1A1 tanks, as a whole, provides equal value to the unit as TOW anti-tank missiles, as a whole.

If a unit initially has 100% of its TOE equipment, its resulting TEL value will equal 100. That unit will be able to perform its mission at 100% efficiency. A PSYOP unit's efficiency is initially based on the resources available to perform its mission. CSC noted that this approach offers an important benefit: "... the player(s) will be forced to deal with the PSYOP issue before the game begins. This is of the utmost importance in setting the tone for the rest of the game (11: 3.7.1)."

Once the game begins, the initial TEL value computed is modified by a degradation factor. This factor comes into play only if the PSYOP analysis process is not refreshed on a daily basis. Because the majority of JTLS exercises simulate less than 1 week of combat (35), I chose a 24 hour period as a reasonable interval for analysis process updating. This forces players to consider the PSYOP analysis process regularly. If they fail to update, degradation occurs according to the following:

$$TEL = TEL \cdot (1 - \frac{D}{100}) \tag{3}$$

where   D = Degradation factor, i.e., 10%.

The degradation factor is selected by the game controllers during the scenario development process. The easiest way to present it to the controllers is in terms of a PSYOP unit's "half-life." For example, see table 4-1.

Day	10% Degradation	20% Degradation	30% Degradation
1	100	100	100
2	90	80	70
3	81	64	49
4	73	51	34
5	66	41	24
6	59	33	17
7	53	26	12
Half-Life	~7 days	~4 days	~3 days

Table 4-1. Sample Half-Life with Varying Degradation Rates

For example, a controller wishes to use a degradation rate such that if the PSYOP unit fails to perform a PSYOP analysis for 4 days, that unit will only be half as effective as if it had updated its PSYOP analysis daily. Consulting the above table, a degradation of 20% is appropriate.

Once the analysis is completed, the next step is to determine which type of product to develop, produce that product, and disseminate it to the target audience.

4.3 Product Development, Production, and Dissemination

The first question that must be asked is "What type of media will I use to deliver my message?" The player should be forced to make this decision independent of any game rules or structure. This drives the player to consider the resource allocations, time constraints, and other real-world considerations. The goal is to impart a new (or better) understanding of what it takes to mount an effective PSYOP campaign.

Due to the time and resource constraints inherent in the development and production of the PSYOP product, I have chosen to explicitly represent product development and production. CSC recommended this and noted, "... to account for (product development and production) in an implicit fashion would probably underestimate the impact of these activities on the PSYOP unit's

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functioning (11: 3.7.2)." PSYOP activities must compete for the same supply, transportation, and facility resources as other actions on the battlefield. Modeling these explicitly drives this allocation process.

4.3.1 Product Development.

Product development takes time. Since it occurs within the operations element of a PSYOP unit, no personnel or equipment resources outside the PSYOP unit are required for development. CSC recommended that the time for the development of a particular product be a function of the media type selected and the outcome of the target audience analysis (11: 3.7.2). Taking this into account, let $T_{Devel, Raw}$ be the time it takes to develop a product under perfect conditions. This value could be found through a 3 dimensional array with elements of mission, audience, and media type. As more data becomes available concerning PSYOP effectiveness, entries could be added to the array and more PSYOP programs may be represented.

Initially, I recommend that media be restricted to 3 types: audio, video, or print. I make this recommendation only for simplicity and ease of data collection. Similarly, I propose that audience be restricted initially to either civilian or military.

Recall that TEL can be seen as a measurement of the PSYOP unit's ability to do its mission, based on the assumption that availability equals capability. I have assumed that the TEL value contains many of the component parts of the analysis process that are important in product development, such as regional/theater information that would impact on the time it takes to develop the product(s) (11: 3.7.2). This must be reflected in determining the actual development time, T_{Devel}, through

$$T_{Devel} = \frac{T_{Devel, Raw}}{(TEL/100)} \qquad (4)$$

This also assumes that sufficient personnel are always available to conduct product development. Development is typically performed by a relatively small number of personnel (graphic artists, interpreters, etc.) contained within the operations section. Additionally, recall that JTLS only tracks two personnel types, combat and support. A PSYOP battalion typically has approximately 500 personnel assigned (at 100% strength) (12: 30). Of these 500, only about 80, or 25%, are above the rank of E7 (Sergeant First Class), the rank structure which usually are eligible to work within the operations section. If I chose to track the influence of personnel limitations in product development, because of the structure of JTLS personnel typing, an E2 generator operator would equal an O3 PSYOP Area Specialist. Taken in this light, my assumption is not overly presumptuous.

4.3.2 Product Production.

Product production, regardless of media type, follows the same general path. Is sufficient material available for the production? Are sufficient personnel available to produce it? Are facilities available in which to produce it? My methodology also follows this outline.

First, consider the material constraints. Let $MATL_{Re\,qd}$ be the amount of material required for the mission. This can be found in a 2 dimensional array with elements of mission and media. It is relatively simple to check the quantity available through existing JTLS psuedocode 6-9, "Determine Quantity Available as Supplies for Issue." Let this amount be called $MATL_{O/H}$, or material on hand. See figure 4-2 for representation in flowchart format.

If insufficient material is on hand for production, first, the player is notified. The player now understands that PSYOP units have resource requirements just as valid and critical as other units. A requisition for additional materials is sent to the PSYOP unit's supporting unit and production is delayed until that material arrives. This delay structure already exists within the logistical portions of JTLS. Otherwise, adjust the amount of material on hand and continue.
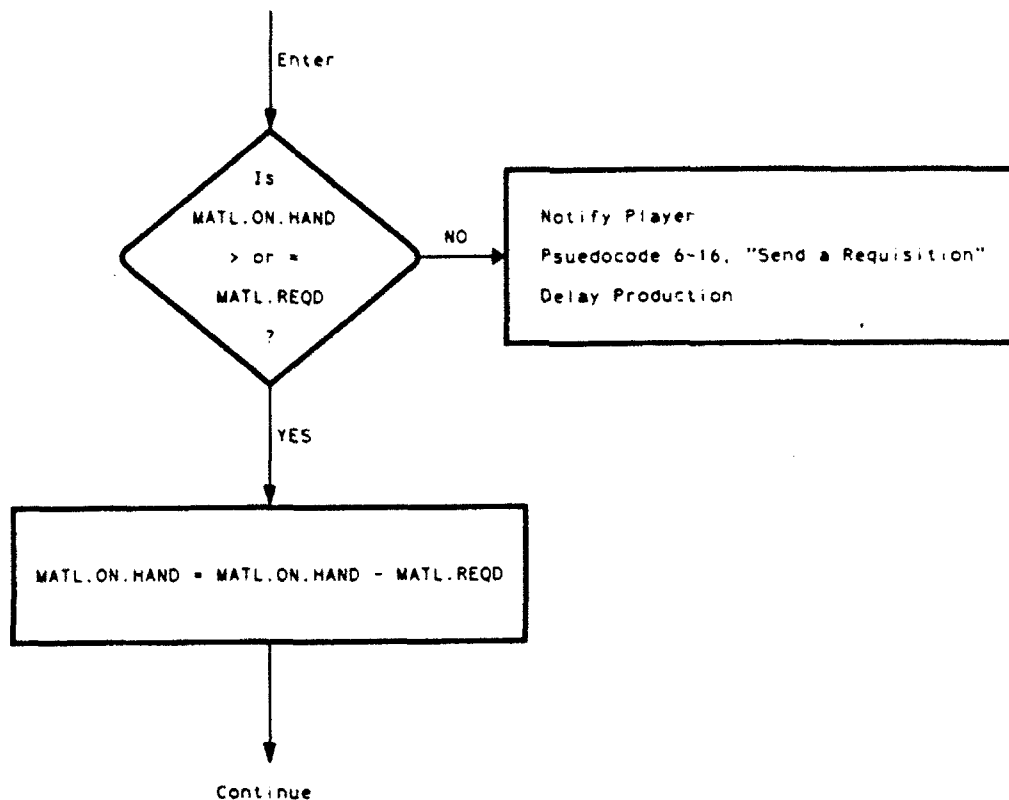
Figure 4-2. Material Constraints Flowchart

Next, are personnel available to produce the PSYOP product? While in reality this is a combination of soldiers with varying ranks and occupational skills, the structure of JTLS forces a simplification. JTLS only tracks 2 broad types of personnel on the battlefield: combat and support. Therefore, personnel available, $PERS_{Avail}$, can be easily computed from the COMBAT SYSTEMS array element, Operational Systems Now.

The personnel required (under ideal conditions) to produce a set amount of media type will be $PERS_{Reqd}$. Are sufficient personnel available to produce the product or $PERS_{Reqd} \leq PERS_{Avail}$? If yes, adjust the amount of personnel available and continue. If no, check again if any (more than 0) personnel are available; does $PERS_{Avail} = 0$? If yes, delay production until personnel become available. If no, adjust the rate at which the product may be produced by the limited number of personnel available (see figure 4-3).
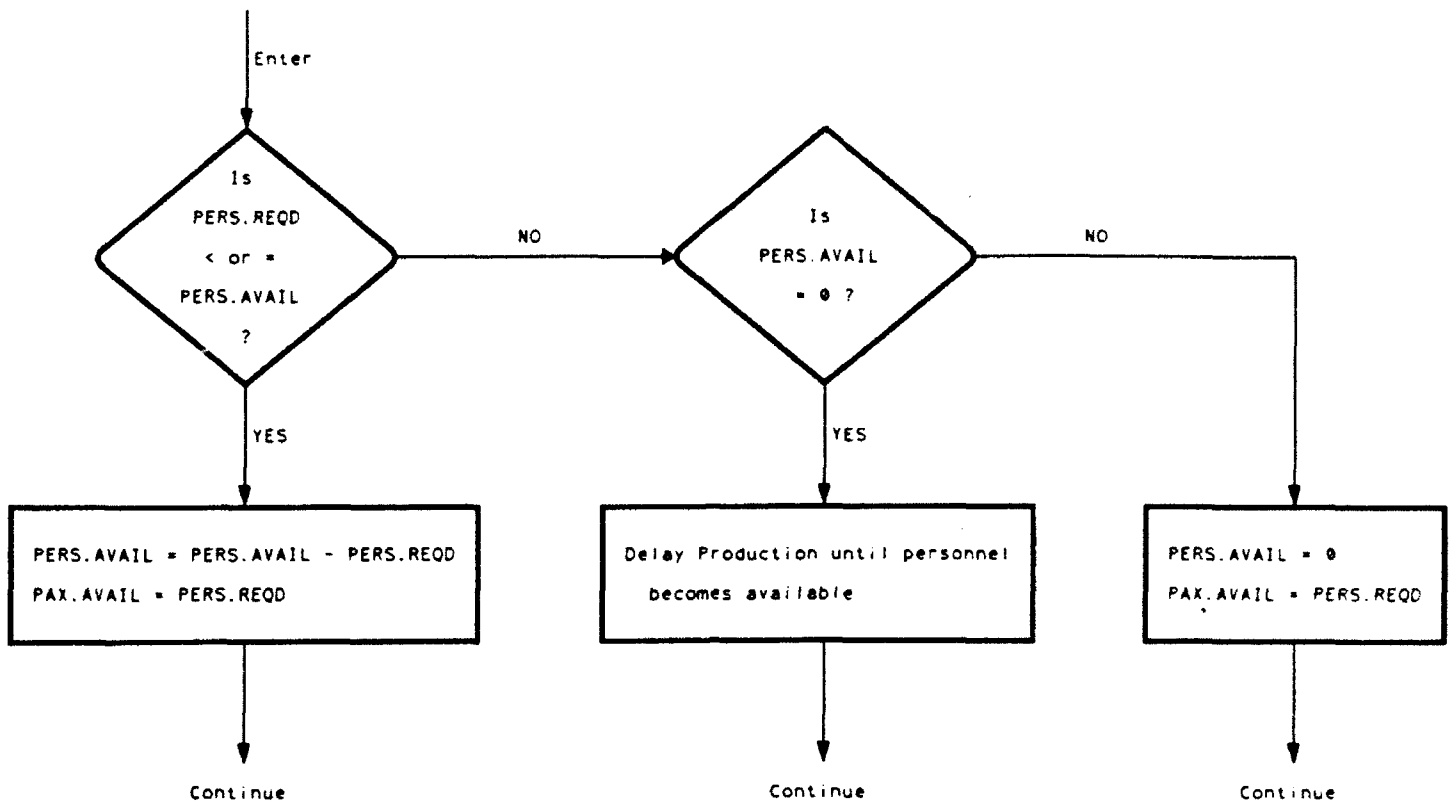
Figure 4-3. Personnel Constraints Flowchart

PAX_{Avail} is only a holder variable. The quantity of product that can be produced is a function of both the personnel available and any facility limitations present. Again, let Q_{Raw} be the quantity of PSYOP products able to be produced under ideal conditions. Q_{Raw} can be found in a 2 dimensional array with elements of mission and media type.

Assuming the actual quantity is a function of both personnel and equipment available:

$$Q_{Final} = Q_{Raw} \cdot \frac{\sum_{i=1}^{n}(\frac{Operational\_Systems\_Now_i}{TOE\_Number_i})}{n} \cdot \frac{PAX_{Avail}}{PERS_{Re\,qd}} \qquad (5)$$

for   i = Combat System Types

where Q_{Final}, Q_{Raw} are in units of the amount of product produced (i.e., number of leaflets, minutes of recording, feet of videotape)

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Once Q_{Final} is determined, the production time can be established through

$$T_{Prod} = Q_{Raw} \cdot Rate_{Prod} \cdot \left(\frac{Q_{Raw}}{Q_{Final}}\right) \tag{6}$$

$Rate_{Prod}$ is in units of time per amount of product produced (minutes per leaflet) and can be found through a one dimensional array with media as its only element. The time the completed product is available for dissemination is the time of request plus development time plus production time.

$$T_{Avail} = T_{Now} + T_{Devel} + T_{Prod} \tag{7}$$

Once the production process is completed, the final PSYOP product can be introduced into the JTLS game as an asset of the producing PSYOP unit by using existing psuedocode 6-45. "Supply Arrival." The PSYOP product becomes an asset of the PSYOP unit, similar to its personnel, trucks, and fuel supplies. They do, however, have a relatively short life span. To model this, once a product is produced, it will have a shelf life of a few days. Because it is so scenario dependent, this number should be set by the JTLS controllers. I recommend a value approximately half of the length of JTLS play. For example, a designated shelf life of 3 days for a week long JTLS scenario. Again, this forces players to understand that PSYOP is a continuous cycle. Similar to military intelligence, the results of a target audience analysis (in this case, the actual PSYOP products) are also time dependent and evolve constantly. PSYOP products cannot be produced in large quantities during day 1 and be distributed for the next 3 weeks. If different media types have differing shelf lives, this value can then be accessed from a 1 dimensional array with elements for media type (11: 3.7.2). Otherwise, one shelf life for all PSYOP material is sufficient.

4.3.3 Product Dissemination.

CSC noted that, "Product dissemination is more similar to a resupply function than to delivery of a weapon system. [They] are produced, are perishable, have a specific target audience,

and are non-lethal. The resupply paradigm seems to fit well for dissemination of the products, and may be the simplest and most natural to implement. (1: 3.7.3)"

The first question that must be examined is if the producing PSYOP unit has assets available to distribute the products. The only organic distribution mechanisms contained within PSYOP units are contained in the PSYOP broadcast companies. Broadcast companies contain a mobile broadcast facility, including power generation equipment with operators (17: 4-6). They also deploy with 5 kW, 10 kW, and 50 kW radio stations, including its supporting antenna and power generation equipment with operators (17: 4-6).

If organic assets are not contained within the PSYOP unit, it must rely on outside units to transport, load, then finally deliver the product to the target audience. Appendix C, Deliver/Disseminate Product shows this in flowchart format. As noted, JTLS currently contains structures that model the shipment/transportation of supplies between supporting/supported units, the scheduling, loading, transportation, and delivery (via airdrop) of supplies with aircraft, both fixed and rotary wing, and the scheduling and firing of artillery missions.

4.4 Determine PSYOP Effectiveness

The vast majority of this research has been concentrated on exactly how to represent the effects of PSYOP products on enemy troops and civilians. While it is readily agreed that PSYOP products do have an influence on the battlefield (for example, by encouraging enemy surrenders), it is difficult to quantify what value PSYOP brings to the combat elements of the modern battlefield. This was exactly the dilemma I faced. I began by looking at the data available. As I stated in Chapter 2, the Johns Hopkin's studies provided a good "feel" for what factors influenced an enemy soldier's choice of surrender. This data clearly showed that a number of factors sway the decision: the military condition of the unit, belief in the good intentions of U.S. forces (i.e., they would not be killed), length of service (i.e., was the soldier a "new guy" or a "vet"?), etc.

4.4.1 Military Targets.

In early 1951, the Johns Hopkins University Operations Research Office was contracted by the Army Operations Research Office to conduct another study "to determine the effect of surrender-mission psychological warfare and of other factors on surrender behavior, and to determine the major differences among Chinese and North Korean prisoners of war in attitudes and experiences of significance to psywar operations (33: 1)." The solution of these problems would serve to provide data indicating which groups represent the "softest targets" among the enemy and the messages and themes most effective in influencing the various target audiences to surrender.

4.4.1.1 Background.

The study's primary hypothesis was based on Bairdain and Bairdain's theoretical constructs outline in chapter 2. In essence, surrender-mission PSYOP can precipitate surrender only in conjunction with those attitudes, situations, and experiences that predispose the enemy to such behavior. The previous research (outlined earlier in chapter 2) was designed to examine factors that might be of some importance in the surrender of enemy forces. A review of that material led to the selection of 7 variables for examination during this study. Questionnaire scales were developed in order to measure the following:

Scale	Description
A	Attitudes toward civilian and military leadership
B	Reactions to physical factors (food, cold, etc.)
C	Group cohesiveness (the degree of identification with the military unit)
D	Reactions toward the military situation
E	Attitude toward the act of surrender
F	Impact of surrender-mission PSYOP
G	Attitudes toward Communist ideologies

Table 4-2. Scale Factors A through G

The questionnaire was submitted to prisoners of war in Korea in September 1951 by the investigators. A total of 2193 POW's answered all the questions. Of that number, 204 were Chinese officers; 799, Chinese enlisted men; 405, North Korean officers; and 785, North Korean enlisted men. The data was then analyzed. The resulting analysis followed from an analysis of the questionnaires.

Scale	Range of Total Scores	Meaning of High and Low Scores	
		Low score	High Score
A	12-60	Faith in and satisfaction with civilian and military leadership	Disaffection with civilian and military leadership
B	6-30	Satisfaction with physical conditions (medical care, food, weather, etc.)	Disaffection with physical conditions
C	5-25	Strong identification with military group (i.e., group cohesiveness, high morale)	Lack of group cohesiveness and absence of identification with fellow soldiers in arms, low morale
D	7-35	Optimistic attitude toward military situation and outcome of battles at time of imprisonment	Pessimistic attitude toward military situation
E	5-25	Strong attitudes against surrender	Weak attitudes against surrender
F	6-30	Expression of ineffectiveness of UN psywar efforts and of its lack of influence on behavior	Expression of effectiveness of UN psywar efforts and of its strong influence on behavior
G	13-65	Favorable attitudes toward communism as a political ideology	Unfavorable attitudes toward communism

Table 4-3. Scales A through G with Scoring Ranges

4.4.1.2 Enemy Unit Profile.

Before I continue with the actual discriminate function development, I need to outline a new initialization action required concerning the enemy units within JTLS. As shown in table 4-3,

seven variables or scales are used. To bring the scale meanings "up to date," change scale F to read "Expression of effectiveness (or ineffectiveness) of US PSYOP efforts and of its strong (or lack of) influence on behavior." Similarly, change scale G to read "Favorable (or unfavorable) attitudes towards political or religious ideology."

Assume each enemy scale distribution is normally distributed with a given mean and variance, $N(\mu_j, \sigma_j^2)$, where j = scales A through G. Let the JTLS user input the enemy's profile during initialization. This allows the user to modify the enemy profile to fit the scenario being played.

In the current format, the ranges of total scores for scales A through G vary from a minimum of 20 to a maximum of 52.. To ease understanding, and simplify the initialization process, I recommend that a uniform range from 0 to 10 be used. The instructions for the input menu could be fashioned as follows:

> "Considering all enemy units in this scenario, provide the enemy's average score between 1 and 10 for the following enemy attributes:" (see table 4-4)

The resulting scales a through g, can easily be converted to scales A through G by the following:

$$A = 12 + 4.8a \qquad B = 6 + 2.4b \qquad C = 5 + 2c$$
$$D = 7 + 2.8d \qquad E = 5 + 2e \qquad F = 6 + 2.4f$$
$$G = 13 + 5.2g$$

Let the A through G values equal the means of the A through G distributions. To determine the variance, recall that for the normal distribution, $\mu \pm 3\sigma$ covers almost 100% of the individual observations. Therefore, let 6σ equal the range of scales A through G. The resulting standard deviations are shown in table 4-5.

To initialize, JTLS generates a normal random variate with mean and variance as indicated. This is done for each enemy unit in the scenario (see figure 4-4).

Scale	Range of Total Scores	Meaning of High and Low Scores	
		Low score	High Score
a	0-10	Strong faith in and satisfaction with civilian and military leadership	No faith and strong disaffection with civilian and military leadership
b	0-10	Very satisfied with physical conditions (medical care, food, weather, etc.)	Very dissatisfied with physical conditions
c	0-10	Very strong identification with military group (i.e., group cohesiveness, high morale)	Very weak group cohesiveness and absence of identification with fellow soldiers in arms, low morale
d	0-10	Optimistic attitude toward current military situation and outcome of future battles	Pessimistic attitude toward current military situation and outcome of future battles
e	0-10	Strong attitudes against surrender	Weak attitudes against surrender
f	0-10	Strong belief in the effectiveness of US PSYOP programs and their influence on behavior	Little or no belief in the effectiveness of US PSYOP programs and their influence on behavior
g	0-10	Favorable attitudes toward political or religious ideology	Unfavorable attitudes toward political or religious ideology

Table 4-4. Scale Initialization Table

Scale	Standard Deviation
A	8.00
B	4.00
C	3.33
D	4.67
E	3.33
F	4.00
G	8.67

Table 4-5. Scale Observation Standard Deviations

```
                    │ Enter: Given scale values a-g
                    ▼
        ┌─────────────────────────┐
        │  For each RED unit       \    Continue
───────▶│    in the scenario        ───────────▶
        └─────────────────────────/
                    │
                    ▼
        ┌─────────────────────────┐
        │  Transform a-g scale values │
        │    to A-G scale values      │
        └─────────────────────────┘
                    │
                    ▼
        ┌─────────────────────────────┐
        │  Generate normal random variates │
        │  with mean, μ, and standard deviation, σ │
        └─────────────────────────────┘
```
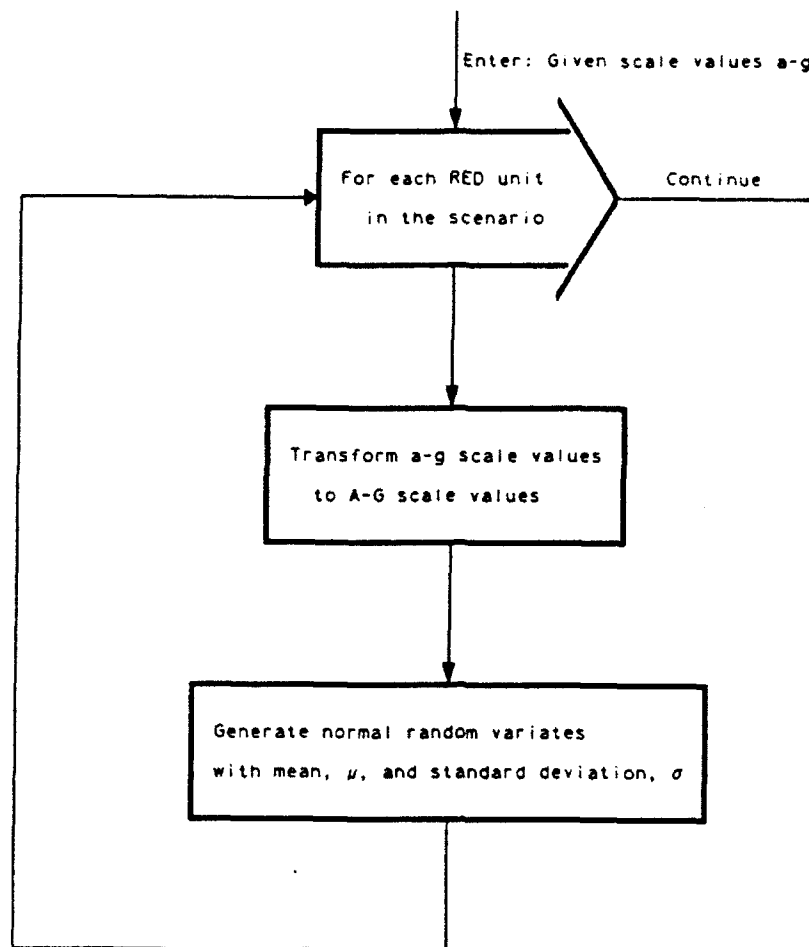
Figure 4-4. Enemy Unit Profile

4.4.1.3 Discriminate Function Development.

One of the big problems I first faced was that the actual data was not available. The only data available was a set of histograms depicting intervals in which the number of POW's (Chinese and Korean, officers and enlisted) fell for each scale (A through G) and whether the POW was captured or surrendered. Recall the definitions of capture and surrender behavior outlined in section 2.4. Without the actual data points, I could make no inference as to the correlation between the scales. If a soldier is not optimistic toward the current military situation, he is probably not satisfied with his civilian and military leadership for putting him in that position to start.

The intercorrelations of the scales were available, however. They follow, grouped by rank (officer vs. enlisted) and country origin (North Korean vs. Chinese Communist).

Chinese Communist Force -- Officers

		A	B	C	D	E	F	G
Leadership	A		.738	.683	.832	.699	.768	.676
Physical Conditions	B			.580	.712	.492	.695	.529
Group Cohesiveness	C				.643	.513	.619	.457
Military Situation	D					.659	.757	.663
Surrender Attitudes	E						.584	.477
Psychological Warfare	F							.503
Communist Attitudes	G							

Table 4-6. Intercorrelations for Chinese Communist Force Officers

Chinese Communist Force -- Enlisted

		A	B	C	D	E	F	G
Leadership	A		.723	.675	.780	.436	.714	.585
Physical Conditions	B			.739	.719	.255	.699	.442
Group Cohesiveness	C				.710	.278	.703	.466
Military Situation	D					.436	.779	.491
Surrender Attitudes	E						.421	.266
Psychological Warfare	F							.412
Communist Attitudes	G							

Table 4-7. Intercorrelations for Chinese Communist Force Enlisted

North Korean -- Officers

		A	B	C	D	E	F	G
Leadership	A		.693	.694	.461	.663	.735	.521
Physical Conditions	B			.551	.533	.497	.606	.377
Group Cohesiveness	C				.433	.568	.629	.434
Military Situation	D					.386	.444	.324
Surrender Attitudes	E						.637	.420
Psychological Warfare	F							.426
Communist Attitudes	G							

Table 4-8. Intercorrelations for North Korean Officers

North Korean -- Enlisted

		A	B	C	D	E	F	G
Leadership	A		.792	.794	.494	.724	.780	.734
Physical Conditions	B			.650	.534	.641	.679	.590
Group Cohesiveness	C				.388	.656	.685	.566
Military Situation	D					.436	.488	.333
Surrender Attitudes	E						.686	.565
Psychological Warfare	F							.605
Communist Attitudes	G							

Table 4-9. Intercorrelations for North Korean Enlisted

Using these, a discriminate function for each category, rank and country, could be developed. The study did provide a breakdown by category and scale of the means of both the surrenders and captures. That information follows:

	CCF-O/S	CCF-O/C	CCF-EM/S	CCF-EM/C	NK-O/S	NK-O/C	NK-EM/S	NK-EM/C
A	46.52	37.85	48.03	37.74	23.06	16.88	42.33	28.95
B	23.01	19.65	24.42	19.02	13.25	10.58	20.83	15.63
C	19.55	16.20	19.83	15.73	10.97	8.47	17.26	12.83
D	27.62	22.03	29.10	21.13	20.08	18.22	23.46	21.01
E	18.21	15.43	17.21	14.09	10.97	8.43	17.09	12.37
F	22.99	18.88	24.76	18.79	13.06	10.42	20.26	15.02
G	52.02	42.15	48.00	40.77	29.08	22.11	44.91	31.62

Table 4-10. Means of Scales by Country, Rank, and Capture-Surrender Behavior

Discriminate analysis is a form a of multi-variate analysis. Given a set of attributes about an object, discriminate analvsis attempts to determine whether the item belongs to one of i groups. In this case, let

$$i = 1, 2 \quad \text{where} \quad \begin{array}{l} 1 \equiv \text{Surrender} \\ 2 \equiv \text{Capture} \end{array}$$

The discriminate function for $i = 1,2$ is found by

$$\hat{d}_i^Q = -\frac{1}{2}(\overline{X}_i' \cdot S^{-1} \cdot \overline{X}_i) + X_0' \cdot S^{-1} \cdot X_0 \qquad (8)$$

where $\overline{X}_i \equiv$ the vector of means for case i

$S \equiv$ variance-covariance matrix

$X_0 \equiv$ the vector of scale values for the unknown case

If $\hat{d}_1^Q > \hat{d}_2^Q$, then the unknown case should be classified as case 1 (in this case, a surrender).

If $\hat{d}_2^Q \geq \hat{d}_1^Q$, then the unknown case should be classified as case 2 (in this case, a capture).

Now let, $\quad \hat{d}_T^Q = \hat{d}_1^Q - \hat{d}_2^Q$, if $\quad \hat{d}_T^Q > 0 \quad$ then assign as 1 (surrender) $\quad (9)$

otherwise $\quad$ then assign as 2 (capture)

For example, the discriminate function for North Korean officers yielded the following:

$$\hat{d}_T^Q = -241.05 + 10.11A - 2.10B - 2.85C - 0.32D - 2.09E - 2.76F + 5.89G \qquad (10)$$

By substituting new values for scales A through G, I can now determine if that unit is more likely to surrender or to be captured. Classification as a surrender assumes that the soldiers will willingly give up. Conversely, classification as capture assumes the soldiers will continue to fight and be either killed or captured through the force of arms. The functions for all the cases are shown in table 4-11.

Unit	Discriminate Function
CCF-O	-736.14 + 17.50A - 5.86B - 2.74C - 3.27D - 5.90E - 1.80F + 8.29G
CCF-EM	-629.13 + 13.52A - 3.40B - 5.92C + 3.56D - 2.74E - 0.57F + 4.38G
NK-O	-241.05 + 10.11A - 2.10B - 2.85C - 0.32D - 2.09E - 2.76F + 5.89G
NK-EM	-989.93 + 37.37A - 11.11B - 13.28C - 1.57D - 4.85E - 8.06F + 8.07G

Table 4-11. Discriminate Functions

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4.4.1.4 Implementation of Discriminate Function.

Now that I have determined how to discriminate between cases more likely to surrender and cases more likely to be captured, the question is how to implement this knowledge. In research also conducted by the Johns Hopkin's university Operations Research Office to evaluate the effectiveness of PSYOP influence on Chinese Communist troops, they found a statistical difference between the capture-surrender behavior of the Chinese Communist Army (fighting on foreign soil) and the North Korean Army (fighting in its homeland) (30: 76-7). It was found that the Chinese rarely left their units to surrender. Reasons cited included both the distance from their home villages and the language difference with the peasant population, among others. Due to this, I recommend the Chinese Communist functions be used when modeling an occupying army and the North Korean functions be used when modeling an army fighting in its homeland.

A unit's character is a direct reflection of its leadership. To attempt to model this, I will evaluate a unit's tendency to surrender through two steps. First, evaluate the unit through the appropriate officer's discriminate function. If the result is surrender, I tag the entire unit as surrender prone and make the necessary adjustments to the Lanchester equations (this will be covered in the next section). If the result is capture, I conclude that the officers would not encourage surrender. Next, evaluate the unit through the appropriate enlisted discriminate function. If the result is capture, I conclude that the entire unit is not prone to surrender. However, if the result is surrender, I tag the entire unit as surrender prone and adjust the Lanchester equations.

This methodology attempts to model the real world influence on behavior that officers of combat units have on their subordinates. If a unit's officers are surrendering, this encourages the enlisted within that unit to do the same. However, a unit's officers may have strong feelings against surrender and its enlisted may feel the opposite. The process is shown in figure 4-5 in flowchart format.

```
Enter: Given scale val.es A-G,

        Occupying or Homeland Army
```
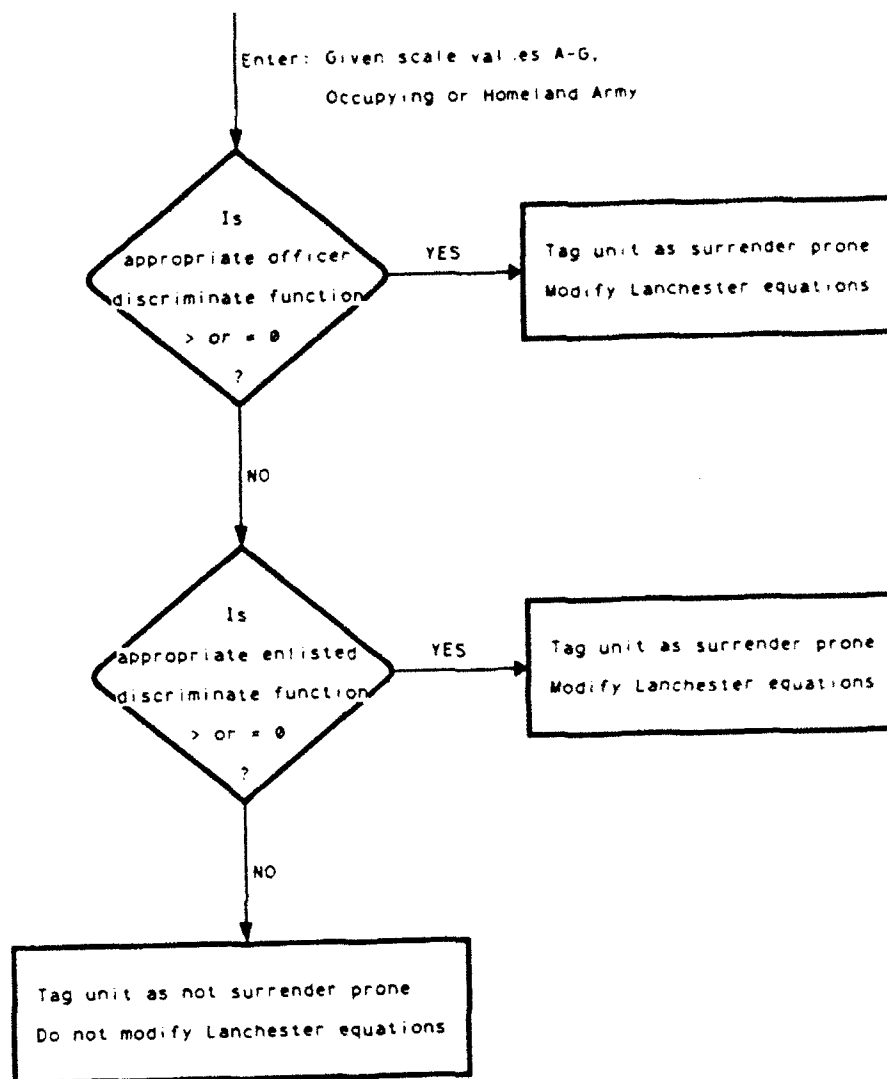
Figure 4-5. Capture -- Surrender Determination

4.4.2 Implementation of PSYOP Effects on Military Targets.

Attrition is one critical part of any war game. Attrition in JTLS is somewhat complicated by the fact that a full heterogeneous Lanchester model is used. The currently used attrition formulas are shown in table 4-12.

Allocation
$$KA_{ji} = \frac{AV_{ji} \cdot CSV_i}{\sum\limits_{k=1}^{N}(AV_{ik} \cdot CSV_k)}$$

Aimed Fire
$$CV_i = \min\left(CSV_i, \sum\limits_{j=1}^{N}(FWL \cdot KA_{ij} \cdot CSK_j \cdot FK_j \cdot AK_j \cdot SOFM)\right)$$

Area Fire
$$CV_i = \min\left(PSVK \cdot CSV_i, PSVK \cdot CSV_i \cdot PSKV \cdot \sum\limits_{j=1}^{N}(FWL \cdot KA_{ij} \cdot (CSK_j \cdot FK_j \cdot AK_j + CSKS_j \cdot FKS_j \cdot AKS_j \cdot SOFM))\right)$$

where:

AK	Ammunition-available switch for a killer combat system type
AKS	Ammunition-available switch for a killer combat system type (supporting unit)
AV	Allocated percentage of a killer combat system type shooting at a victim combat system type in the standard force divided by the number of a victim combat systems type in the standard force
CV	Casualties of a victim combat system type
CSV	Number of a victim combat system type
CSK	Number of a killer combat systems type
CSKS	Number of a killer combat systems type (supporting unit)
FK	Fuel deficiency penalty for a killer combat system type
FKS	Fuel deficiency penalty for a killer combat system type (supporting unit)
FWL	FWL coefficient (Lanchester attrition coefficients)
KA	Allocated percentage of a killer combat system type shooting at a victim combat system type
N	Number of combat systems in the scenario
PSVK	Fraction of victim unit sharing a hex edge with killer unit
PSKV	Fraction of killer unit sharing a hex edge with victim unit
SOFM	SOF Multiplier, 1.0 for non-SOF units
i	Current victim index
j	Current killer index
k	Victim index over all victim units

Table 4-12. JTLS Attrition Formulae

Lanchestrian attrition is used by ground units in combat. Both a direct fire and an area fire formulation are used. Heterogeneity is inherent because individual combat system types attrit enemy combat system types individually. Combat is initiated when a non-covert unit enters or attempts to enter a new hex. Generally, SOF units are designated as covert; because of their advanced skills and abilities, they move in "stealth" and can only be detected by an active enemy search. If a unit is found to be adjacent to or in a hex containing an enemy unit, JTLS determines whether or not either unit is capable of attriting the other. The COMBAT INDEX array is accessed to determine this. COMBAT INDEX is a 5 dimensional array containing the elements of (1) side of the killer, (2) day/night, (3) weather index, (4) killer posture, and (5) victim posture. If the value in COMBAT INDEX is non-zero, attrition can occur; otherwise, no attrition takes place. Additionally, at least one of the unit's combat systems must be able to reach the other unit. This is checked using the longer of each unit's maximum indirect fire range and maximum direct fire range (21: 7-114 -- 7-115).

When a "reinforcing" relationship is established between one unit and another, the indirect fire combat systems belonging to the reinforcing unit are added to those of the reinforced unit for the purposes of attrition assessment. A unit may enter a reinforcing relationship if:

1. The reinforcing unit is not already being reinforced.
2. The reinforcing unit is not already reinforcing another unit.
3. The reinforced unit is not reinforcing some other unit.

When a unit being reinforced by another unit is attriting an enemy unit, the reinforced unit uses all the operational indirect fire combat systems of the reinforcing unit just as it uses its own systems. if:

1. The reinforcing unit is within range of the victim unit.
2. The reinforcing unit is not itself in combat with any opposing unit.
3. Ammunition is available for the indirect fire systems.

If a unit is out of fuel, the efficiency of the systems in it may be reduced. An aircraft without fuel cannot attrit; a tank without fuel may attrit, but cannot move and will itself be attritted

faster; an artillery piece without fuel may still attrit as normal. This assumption is taken into account through FK and FKS.

The FWL coefficient is the Lanchester attrition coefficient. For direct fire systems, its units are casualties per attritor per ASSESS.COMBAT.TIME; for indirect fire systems, casualties per attritor per potential victim per ASSESS.COMBAT.TIME. The FWL coefficient determines the "kills per killer" (direct fire) rate or a "kills per killer per victim" (indirect fire) rate. The entries in the FWL.COEFFICIENT array are the number of casualties caused by a single attriting system or the number of casualties caused by a single system attriting another single system in a single ASSESS.COMBAT.TIME. It is a rate per unit time, but is non-linear (22: A-257 -- A-258).

CV is the casualties of a victim combat system type. This number is found from the minimum of 2 numbers: the actual number of victim combat systems type (or 100% is attritted) or the results of the Lanchester equation (0 to 100% is attritted). It represents the actual number of casualties inflicted on an opponent's combat system type. For example, if 12 RED T-72 tanks go against 10 BLUE Bradley Fighting Vehicles (BFV). Attrition occurs on both sides simultaneously. For the RED side, CV for i = BFV might equal 4. Similarly, for the BLUE side, CV for i = T-72 might equal 6. The RED side suffered 50% casualties (6 of 12) and the BLUE side, 40% (4 of 10). The min (,) of the functions ensure that JTLS does not kill more combat systems than are actually present.

I recommend that the Lanchester equations be modified as shown in table 4-13. PSYM, the PSYOP modifier, is set to 1.0 by default. That is, in most instances, PSYM will not have any influence on the number of casualties of a victim combat system type. However, consider when I have tagged an enemy unit as surrender. Surrendering soldiers are much less likely to fight and will not resist being taken. Once a unit has been tagged as surrender, change that unit's PSYM to a value below 1.0. Initially, I recommend using one of three values for PSYM, 0.8, 0.5, or 0.3.

Aimed Fire Present Form: $$CV_i = \min\left(CSV_i, \sum_{j=1}^{N}(FWL \cdot KA_{ij} \cdot CSK_j \cdot FK_j \cdot AK_j \cdot SOFM)\right)$$	
Aimed Fire Recommended Form: $$CV_i = \min\left(CSV_i, \sum_{j=1}^{N}(FWL \cdot KA_{ij} \cdot CSK_j \cdot FK_j \cdot AK_j \cdot SOFM \cdot PSYM)\right)$$	
Area Fire Present Form: $$CV_i = \min\left(PSVK \cdot CSV_i, PSVK \cdot CSV_i, PSKV \cdot \sum_{j=1}^{N}(FWL \cdot KA_{ij} \cdot (CSK_j \cdot FK_j \cdot AK_j + CSKS_j \cdot FKS_j \cdot AKS_j \cdot SOFM))\right)$$	
Area Fire Recommended Form: $$CV_i = \min\left(PSVK \cdot CSV_i, PSVK \cdot CSV_i, PSKV \cdot \sum_{j=1}^{N}(FWL \cdot KA_{ij} \cdot (CSK_j \cdot FK_j \cdot AK_j + CSKS_j \cdot FKS_j \cdot AKS_j \cdot SOFM \cdot PSYM))\right)$$ where:	
PSYM	PSYOP Modifier; 1.0 by default

Table 4-13. Proposed Attrition Formulae Modifications

Initially, I considered adjusting PSYM to a single value, say 0.5 . This can be seen as 50% of the unit surrendering (or not fighting), because that unit will only inflict 50% as many casualties on opposing units during attrition. By modifying PSYM to a value between 0 and 1, this represents a surrender rate of $1 - PSYM$. I recommend using 3 different possible settings for surrender tagged units to allow for some sensitivity within the PSYOP structure. Assuming an across the board 50% surrender rate for all units whose discriminate function value is greater than 0 is not reasonable. To model this difference in surrender rates, I chose three levels of surrender: few, some, and most. I arbitrarily chose 0.3, 0.5, and 0.8 to represent these levels. These values offer general guidelines to accommodate a range of scenarios. These values should be set by JTLS controllers on a by-scenario basis.

I began by assuming that the larger the positive value of the discriminate function, the more likely the unit is to surrender. For example, consider the foreign army officer discriminate function, $-736.14 + 17.50A - 5.86B - 2.74C - 3.27D - 5.90E - 1.80F + 8.29G$. Using the range of scores for scales A through G, the maximum value of this function is

$$-736.14 + (17.50 \cdot 60) - (5.86 \cdot 6) - (2.74 \cdot 5) - (3.27 \cdot 7) - (5.90 \cdot 5) - (1.80 \cdot 6) + (8.29 \cdot 65) = 743.66$$

The range of "surrender tag" scores is from 0 to about 750. I divided this into 3 equal sections of 250 each. Table 4-14 shows a breakdown of discriminate scores, surrender level, and corresponding PSYM value. Again, I must emphasize that these discriminate function values and PSYM values are not based on any specific data; it is included simply to allow for some sensitivity concerning PSYM. Failing to use this sensitivity presumes that, if surrender prone, all units (regardless of scale values A-G) will have a 1-PSYM surrender rate.

Discriminate Function Value	Surrender Level	PSYM
0-250	few	.8
250-500	some	.5
>500	most	.2

Table 4-14. Discriminate Scores, Surrender Level, and PSYM for Foreign Army Officers

My overall approach has a number of advantages. First, it accurately portrays the effect of PSYOP. An enemy unit may be targeted for PSYOP by a specific opponent, but the effects of that PSYOP program is available for all other units to exploit. Also, it does not allow JTLS players to "game" themselves into an overly advantageous position. By setting PSYM to a specific value (i.e., 0.5) instead of a percentage of the current value, I eliminate rewarding players for "dumping" multiple PSYOP programs on an enemy unit to achieve better results (i.e., $0.5^5 = 0.03$).

4.3 Civilian Targets. There is no data available from any time frame concerning the effectiveness of PSYOP on civilian targets. It has not been studied. Instead, I looked at the desired results and developed a methodology that implemented those procedures.

At present, JTLS only plays 2 sides: RED and BLUE. However, future updates will allow for coalition warfare, or multi-sided play (9). Civilian interaction with combat forces will be allowed.

I wanted to model increased cooperation with the host nation populace as a result of an effective PSYOP program. In my military target methodology, this increase in effectiveness was realized by lowering the effective combat power of the enemy unit. However, in normal circumstances, there is no civilian-military combat. Any "civilians" who do participate in combat should be classified as guerrillas or insurgents. There is no analogous way to lower the civilian's effectiveness.

Due to this, I have chosen to increase the effective combat power of friendly units operating in the vicinity of the targeted civilian population. All friendly units operating either the hex targeted or surrounding hexes will have their PSYM increased to 1.2 for a 24 hour period (see Appendix C: Civilian Targets). This 20% rise should be large enough to reinforce the correct behavior: use PSYOP in conjunction with other weapons systems and get a benefit. At the same time, a 20% increase is not too large; it would not encourage "gaming" PSYOP play. Because PSYOP programs are of a time-sensitive nature, a 24 hour time limit is imposed. This could be modified easily by JTLS controllers based on the scenario played and length of the game.

4.5 New Initialization Actions

My methodology requires 2 new initialization actions to be performed prior to game start-up. First, the enemy profile must be entered. That procedure was outline in section 4.4.1.2. Then, the PSYOP units must be given their preconflict TEL value.

4.5.1 PSYOP Unit Profile. As outlined in section 4.2, each PSYOP unit needs to have an initial TEL value computed. This value will decrease according to the degradation rate, D, if the order is not given to conduct another PSYOP analysis. The JTLS special operations controller (or the controller working with the J3, if PSYOP planning is conducted there) will have an integral role. He will serve as truth-checker and determine if, indeed, the PSYOP analysis process was updated. If this role is neglected, there is nothing to stop the JTLS player from conducting a pseudo-update and inputting this information into the JTLS game system. The controller's supervisory role is necessary to prevent the PSYOP update from being "lip-serviced" or ignored altogether.

Assuming a proper update is conducted, the player will be authorized to "Update the PSYOP Analysis" through the JTLS computer. This action will reset the variable, TIME.TEL, to the current game time.

4.6 Summary

This chapter provided recommendations for one method of integrating PSYOP activities into future versions of JTLS. It is important to understand that I have made no cause and effect relationship between the various stages of PSYOP play (PSYOP analysis, PSYOP product development, production, dissemination, determination of capture-surrender behavior, and implementation of the effects). Any cause and effect relationships inferred about the value of additional PSYOP assets (i.e., 3 extra loudspeaker systems = 10% more surrenders) is beyond the scope warranted by the procedures described here. Chapter 5 contains my conclusion and recommendations for future research efforts.

V. Conclusion

5.1 Summary

This thesis provides a methodology for representing current U.S. Army psychological operations doctrine in the Joint Theater Level Simulation (JTLS) combat model. My methodology incorporates the PSYOP analysis process, the PSYOP product development and production processes, the PSYOP product dissemination process, and a determination of the effects (if any) of those PSYOP products on an enemy or civilian target audience. As JTLS currently exists, no PSYOP play is modeled. As a training tool, users would be better served by including PSYOP in future versions of JTLS.

The research achieved each supporting objective in shown in figure 5-1. Chapter 2 reviewed current PSYOP doctrine and tactics, examined various PSYOP effectiveness studies, and outlined the current state of PSYOP in combat models. Chapter 3 presented a methodology for determining which PSYOP tasks to prototype (see Appendix B), developing those tasks as prototypes, and validating my prototype structure. Finally, chapter 4 discussed the methodology represented by the flowcharts and psuedocode in Appendix C. Appendix E contains a listing of assumptions I made in developing the methodology.

5.2 Recommendations

A prominent wargame developer, James Dunnigan, suggests 10 steps in the evolution of a wargame. While this research did not develop a wargame, it does provide an extension to the existing combat simulation, JTLS. Dunnigan's steps are directly applicable to the combat model developer. These steps are:

    1. Concept development

2. Research

3. Integration into prototype

4. Flesh out the prototype

5. Prepare a first draft of the game rules

6. Development/Play testing

7. Blind testing

8. Produce final rules

9. Production

10. Feedback (Dunnigan: 236-9)

Objective	Current Status	Prototype Goal
Target Audience Analysis Process	Not represented	Implicitly represented as a continuous process
Product Development and Production Process	Not represented	Explicitly represented; media selection assumed
Product Dissemination	Analogous to Resupply Operations	Incorporate PSYOP products into existing structure
PSYOP Effects on Soldiers	Not represented	Quantify an Estimate of PSYOP's Effects on Enemy Troops
PSYOP Effects on Civilians	Not represented	Model Aggregate Effects on Civilians

Table 5-1. Comparison of Current Model Status and Research Goals

The survey conducted by U.S. Special Operations Command (recall section 1.3) served as step 10 and led to the requirement for PSYOP representation within JTLS. My research started the process over again and completed through step 2. The preliminary work for steps 3 and 5 was also finished. Steps 6 through 9 links directly to the validation process. The code writers for the JWC must now begin integration of PSYOP in steps 3 through 9.

Integrating my methodology into JTLS is not a trivial issue. There is still much data to be collected to produce the necessary look-up tables and routines to be written to implement my

recommended methodology. I recommend that the integrated version offer the user my actual prototype task listing as possible PSYOP missions. The underlying structure of my methodology contains basically only 2 PSYOP tasks: (1) Direct PSYOP against a military target, and (2) Direct PSYOP against a civilian target. By using my entire listing of PSYOP tasks, the user will get a better appreciation of what exactly PSYOP can offer as a combat multiplier.

Although most of the follow-on work to this thesis is in implementing the prototypes, there is another issue worthy of furhter attention. The U.S. military must make a concerted effort to gather more data on the quantifiable effects of PSYOP on both civilian and military targets. A forty year lapse in the study of PSYOP effectiveness is too long. PSYOP is obviously a very powerful weapon if used at the proper time against the proper audience. Determining a better estimation of exactly when and against whom is essential. Operation Desert Storm provided an outstanding opportunity to do exactly this. However, due to the fast pace of the ground battle and the vast numbers of Iraqi prisoners, this was not accomplished (3). This chance should not be missed again. Likewise, future U.S. humanitarian missions offer an outstanding prospect for gathering previously uncollected data on the effects of PSYOP on civilian targets.

5.3 Conclusion

This thesis provides the documentation and groundwork for implementing PSYOP in the JTLS combat model. This initial work must certainly precede the writing of any code. The material in Chapter 4 and Appendices B and C provide enough background material to start the programming process. There is clearly room for improvement. As it stands, this thesis is only the first attempt to model PSYOP processes explicitly and estimate the quantifiable effects of such PSYOP on an enemy or civilian population. Only through a determined data collection plan and continued studies can JTLS persevere as a credible, valid combat simulation.

Appendix A. JTLS Combat Model Summary

Background

The Joint Theater Level Simulation (JTLS) is an interactive two-sided analytical tool that models joint air, land, and naval warfare environments (23). It was designed with the following purposes:

    a.   The analysis, development, and evaluation of contingency plans and joint tactics.

    b.   The evaluation of alternative military strategies.

    c.   The analysis of combat systems (20: jtls.txt).

Since then, it has grown into a training model for joint operations. Its users include U.S. Pacific Command, U.S. Atlantic Command, U.S. Southern Command, U.S. European Command, NATO: SHAPE Technical Center, and a number of Department of Defense service schools (9) (35).

Battlefield Representation

JTLS uses a hex-based terrain system. Its 6-sided hex sizes range from 7.5 to 16.5 kilometers (depending on the scenario being played). Each hex in the hexagonal overlay is identical in size and shape to the next. JTLS uses the Lambert Conformal Conic Projection because of that projection's ability to preserve shape relationships over large areas. Each hex is assigned a uniform terrain type (for ground uses) and altitude (for aircraft uses) in the database. This terrain type affects the movement rate of ground units crossing the hex and other factors which affect attrition on ground units in the hex.

Terrain types for some hexes may change during the course of the game. The terrain type may be degraded due to enemy action (artillery fire) and be subsequently upgraded by engineering action. The following terrain types are supported:

1. Good Road
2. Poor Road
3. Open
4. Forest Good Road
5. Forest Poor Road
6. Forest
7. Desert Good Road
8. Desert Poor Road
9. Desert
10. City
11. Rubbled City
12. Mountain Good Road
13. Mountain Poor Road
14. Mountain
15. Ocean (ground units cannot enter; naval units may not leave)

Barriers (river, tank ditch, etc.) are mapped along the hex boundaries. Roads are mapped

hex center to hex center. The following barrier types may be modeled:

1. Limiting
2. Difficult
3. Open
4. Wadi
5. Lightly Bridged Wadi
6. Bridged Wadi
7. Heavily Bridged Wadi
8. Tank Ditch
9. Lightly Bridged Tank Ditch
10. Bridged Tank Ditch
11. Heavily Bridged Tank Ditch
12. River
13. Lightly Bridged River
14. Bridged River
15. Heavily Bridged River
16. Navigable River
17. Lightly Bridged Navigable River
18. Bridged Navigable River
19. Heavily Bridged Navigable River
20. Lightly Restricted Area
21. Restricted Area
22. Heavily Restricted Area
23. Shore
24. Shore LCAC (Amphibious landing possible only with LCAC boats)
25. Impassable (21: 3-5 - 3-8)

JTLS allows for both day and night conditions and operations. Game start always occurs

at midnight. At sunrise, the entire gaming area changes from night to day; at sunset, from day to

night. Similarly, only one weather condition is allowed for the entire gaming area. By default, this weather condition is set to 1, good weather. Three conditions may be modeled: sunny (1), cloudy (2), and foggy (3). Weather alters the capabilities of objects to detect, deliver weapons, and fight (22: A-663).

Unit Representation

JTLS aggregates on the ground at the Brigade/Regimental level (within 16.5 km hexes) or at the Battalion level (within 7.5 km hexes). The exceptions to this aggregation include special operations forces, precision guided munitions/systems, and specified target systems (23). The three ground combat assets available to JTLS players are units, combat systems, and supplies. Units are composed of both combat systems and supplies.

Each unit is assigned a type attribute (ground, air or sea) and a subtype attribute. The seventeen subtypes of ground units follow:

1. Light Artillery
2. Heavy Artillery
3. Infantry
4. Armor
5. Mechanized
6. Engineer
7. Cavalry
8. Air Assault
9. Air Assault Aviation
10. Combat Brigade, Air Cavalry
11. Airborne Artillery
12. Air Assault Artillery
13. Infantry Division Artillery
14. Mechanized Infantry Division Artillery
15. Air Defense Artillery
16. Special Operations Forces (21: 7-5).

Seven arrays contain the combat system information used to model each unit.

Combat System Information Arrays

ARRAY NAME	DESCRIPTION
NAME COMBAT SYSTEMS	Text array containing combat system names.
COMBAT SYSTEMS CHARACTERISTICS	Contains quantitative characteristics of each combat system, such as combat range, and weight
COMBAT SYSTEM PACKET SIZE	Contains a reference number used to determine the point damage attrition for each combat system
COMBAT SYSTEMS	Describes the current status of each units combat systems
COMBAT SYSTEM DENSITIES	Contains the number of combat systems per square meter in the area covered by fire, as determined by four parameters (color of victim, posture of victim, terrain type, and combat system)
AREA LETHALITY COMBAT SYSTEMS	Contains the lethal area in square meters, indexed by lethality index of the fired weapon and by combat system
COMBAT SYSTEM CAN FIRE	Contains binary entry indicating whether a combat system i can fire targetable weapon j

Units in JTLS have both a mission and a posture. The mission is usually the last thing the unit was ordered to do (through the player interface). The posture is what the unit is actually doing. JTLS attempts to keep a unit in the posture of its mission. There are a total of 12 postures represented; the first 5 are player-requested postures (missions) and the remaining 7 are JTLS-assigned postures:

1. Attack
2. Defend
3. Delay
4. Withdraw
5. Move
6. Hasty Defense
7. Air Ops

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8. Incapable
9. Amphibious
10. Formation
11. Wiped Out
12. Inactive (21: 7-26).

Time Advance Mechanism

Time is advanced in intervals of ASSESS.COMBAT.TIME. ASSESS.COMBAT.TIME is the time between assessments of the results of the Lanchestrian attrition in ground combat. This value can range between 1 minute and 1 year and is set by the controllers early in the database preparation process (22: A-94).

JTLS recommends that ASSESS.COMBAT.TIME be under 24 hours because of some underlying assumptions. Combat and attrition results are calculated at the end of each ASSESS.COMBAT.TIME. If a unit moves into contact just before the assessment of combat, JTLS assumes that the unit has been in combat the entire period. It causes and receives an entire interval's worth of attrition. Similarly, if a unit moves out of contact just prior to the assessment of combat, no attrition takes place (22: A-94).

Command and Control Processes

The chain of command is explicitly represented in JTLS. Each of the forces must have a single senior higher headquarters for that force. This senior unit may have a number of subordinate units.

This senior-subordinate relationship has a limited effect on JTLS game play. Some directives may specify that they are to apply to all subordinate units (i.e., SITREP's, situation reports) (21: 4-2). All messages, except for supply requisitions, move in the established chain of command. Intelligence messages are modeled as moving from the source unit directly to the senior headquarters (of that side).

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Each directive or request for information has a specified delay associated with it. The 3 types of delays follow:

1. Higher Headquarters -- delayed as though coming from the highest headquarters on that side.
2. Next Higher -- delayed as though coming from the unit's immediate superior.
3. No Delay -- no delay, a local request or order.

Communications are also modeled explicitly in JTLS. The only form of degradation is the delay of messages in transit. All messages eventually arrive, though delayed for a long time. This delay results from the distance between the sender and receiver, their C3 capability, and enemy jamming (22: 4-5).

Normal delay is calculated through:

$$\mu = \frac{k(i) \cdot D}{100 \cdot C} \quad \text{and} \quad \sigma = \mu / 4.0$$

where m = mean of distribution
s = standard deviation (1/4 of the mean)
k(i) = time delay per 100 km for the ith side (side sending the message)
D = distance between sender and receiver
C = min (sender's C3 systems count, receiver's C3 systems count)

The unjammed delay time is then drawn from a Gaussian random distribution (21: 4-7). A random draw from a uniform 0 -1 distribution checks to see if implicit jamming occurred. If the uniform draw is greater than the Gaussian random draw, no jamming occurred.

Jamming is both implicitly and explicitly represented. Each side in the game has a set probability of jamming, the probability that 1 side will jam a message sent by the other. Additionally, communications jammer or air electronic jamming missions may be flown (21: 4-5 - 4-10).

Movement Process

Movement is determined through one of the three possible combinations of the following movement processes:

Minimum Distance. JTLS uses Dijkstra's algorithm to determine the minimum distance to destination. This process is used by default for all ground moves. If a unit in movement encounters an impassable barrier, then the movement will be determined by the minimum time process.

Minimum Time. The minimum time process uses "virtual convoys" that transit from hex to hex to determine the route that takes the minimum time to arrive at the destination. If a virtual convoy enters a hex that has been transited, then that virtual convoy is destroyed. The first virtual convoy to reach the destination determines the route that takes the minimum time. Movement through an impassable barrier incurs an infinite cost.

By default, JTLS attempts to avoid hexes containing enemy units. This priority of avoidance follows:

1. Avoid a hex containing an enemy unit, if possible.
2. Avoid a hex containing only enemy units, if possible.
3. Ignore enemy and find the optimal route.

Covert Movement. Covert movement also is modeled. Only special operations forces can use covert movement. Units using covert movement move slower, but have a lower probability of being detected. Only enemy units in an active search for covert moving units may detect units moving covertly. Once a SOF unit is detected, it can be attacked. If attacked, SOF units attempt to break contact, withdraw from the area, and regain their covert movement status. However, SOF units moving covertly cannot destroy enemy units encountered.

Travel time is influenced by the following factors:

1. Distance
2. Speed
3. Barriers encountered
4. Nuclear, chemical, and/or biological effects
5. Posture related delays

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6. Congestion in the hex

7. Covert movement or covert searching status

8. Indirect fire

Intelligence Process

The JTLS intelligence processes provide information to the players on the status of their own forces and known enemy forces. "JTLS intelligence is based on the assumption that intelligence fusion, correlation, identification, and reporting functions occur (21: 10-1)." This same ability is also a limitation; once detection is made, all information is known. This limits the training for intelligence staffs; however, JTLS can be linked with other programs (such as the Joint Exercise Driver for Intelligence, JEDI) to overcome this constraint.

JTLS reports processed information, rather than the raw data. This reported information is accurate. To restrict the amount of perfect information presented, JTLS uses the following methods:

1. Information is delayed; information seen by the player may be inaccurate at the time of receipt.

2. Information on an enemy unit or target is subject to a probability of detection; only detected objects are reported.

3. The amount of information obtained is dependent on how long the asset has available to observe the enemy.

JTLS models five different intelligence assets: external assets, 2 type of tactical gathering capabilities of units, special human intelligence (humint) teams, and air reconnaissance. These assets may be limited to only certain types of information about the enemy. For example, air recce assets cannot collect information on an enemy unit's combat distribution or supporting unit. Similarly, humint teams cannot detect supply runs (21: 10-3).

Additionally, tactical intelligence is collected by ground and air units. For ground units, a radius is used to determine the hexes that are within the ground intelligence-gathering capability of that unit. Air units have a similar radius. Air recce missions (if flown) will detect and report more

information than air tactical intelligence. For example, air recces report enemy convoys, but air tactical intelligence does not (21: 10-20 - 10-38).

Humint intelligence is gathered by small teams. These teams are a limited resource for each unit. They are free to go anywhere on the playing board. JTLS does not model how a team arrives at an assigned location; it only simulates how long the travel would have taken. These teams are subject to detection and attrition when they are inserted at their observation point, while they are at that point, and upon extraction (21: 10-39).

Information is also gathered on friendly units in the form of situation reports. The situation report (sitrep) is used by the commander to get information about subordinate units. These sitreps are subject to the time delay process outlined earlier. A sitrep contains the following information:

Situation Report

Information	Meaning
Unit Identification	Short name of the unit whose situation is being reported
Location	Latitude and longitude, to the nearest second
Posture	Unit posture at the time of the report
Current Strength	Decimal fraction of TOE strength
Support Unit	Short name of unit that provide routine logistical support or "none"
Facing	Direction the unit is facing: N, NE, NW, S, SE, SW
Number Aircraft	# aircraft available to be committed, if a squadron
Travel Time	Time remaining in the move and estimated arrival time, if a unit is moving

JTLS provides for multiple perceptions on the battlefield: Blue/Red/Truth. For example, the Red perception is shown on the Red graphics terminal and detailed on the Red information management terminal. It shows his own forces and those Blue forces that Red has detected. Those positions are current as of the latest detection time, however, intelligence assets must continue to be tasked to update information on the Blue unit or good locations will be lost as the Blue units move on the battlefield.

Logistical Processes

Logistics may be modeled asymmetrically, to allow for the comparison of different logistics doctrines or practices between simulation runs. JTLS can model the following logistical constraints:

1. JTLS permits an unlimited supply *capability*. Under this assumption, combat is totally unrestricted by the availability of supplies.

2. JTLS permits the normal constrained supply availability, automatic requisitioning, and automatic (player initiated) PUSH shipments.

3. JTLS permits the high resolution micro-management of logistics through the use of directed resupply, airlift, airdrop, reorder level, and stockage objective directives (21: 3-5 - 3-7).

The following logistics capabilities exist in JTLS:

1. Movement of supplies between units by truck, barge, or rail

2. Mandatory transfer of supplies from one unit to another

3. Automatic or player-directed resupply of units

4. Creation of logistics loads for use in future operations

5. Creation of caches for future use

6. Operation of pipelines, including the drawing of supplies from the pipeline and replenishing supplies

7. Capture of enemy supplies and recovery of friendly supplies

8. Modification of the storage objectives and/or reorder thresholds for one or more categories of supplies for either a single unit, a group of units, or all units

9. Change the depot from which a unit orders its supplies from which a pipeline is replenished

10. Airlift operations (through the air module); an aircraft squadron or helicopter company is capable of lifting either a unit or supplying loads from a loading location to an off loading location

11. Airdrop operations (through the air module); an aircraft squadron or helicopter company is capable of air dropping a unit or supply load at a specified location or an alternate location

12. Sealift operations (through the naval module); a naval unit or formation is capable of sealifting either a unit or a supply load from a loading location to an off loading location (21: 4-3 - 4-5).

Target Representation

In JTLS, a target is a significant object that is not a unit (i.e., bridges, runways). There are a total of 30 category types represented. Targets of some categories have an effect on the play of the game; others do not.

Targets may be owned by Blue, Red, or neither. Runways, Surface-to-Air missile sites, anti-aircraft artillery sites are examples of targets that are typically owned by one side or the other. Bridges and tunnels are examples of targets that are classified as Neutral (21: 4-18 - 4-21).

1	Anti-Aircraft Artillery (AAA) Site*	16	Tanks
2	Surface-to-Air Missile (SAM) Site*	17	Troops
3	Highway Bridge*	18	Mixed Armor
4	Railroad Bridge*	19	Command Post
5	Tunnel*	20	Underground Storage*
6	Radar Site*	21	Reinforced Storage*
7	Runway*	22	Vehicles
8	Road Interdiction Point*	23	Supply Open Storage*
9	Rail Interdiction Point*	24	Aircraft Shelters*
10	Ship	25	Helicopters
11	Ammunition Storage	26	Aircraft
12	Armored Personnel Carrier (APC)	27	Material Handling Equipment*
13	Artillery	28	Minefield*
14	Rocket Launcher	29	Pumping Station
15	Surface-to-Surface Missiles (SSM)*	30	Jammer*

Ground Attrition Processes

JTLS uses three basic attrition mechanisms for ground combat attrition. One is a deterministic, time-stepped, mixed heterogeneous Lanchester model. The other two are an expected value method (used to assess the results of a targetable area damage weapon) and a probability-of-kill, pK, mechanism (used to assess the results of a targetable point kill weapons and encounters between supply runs and enemy units) (21: 7-113).

Lanchestrian Attrition. Lanchestrian attrition is used by ground units in combat. Both a direct fire (aimed fire) and area fire formulation are used. Individual weapon system types attrit enemy combat system types individually; this is the heterogeneity aspect of the formulation. The following factors influence attrition:

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* denotes targets that may affect game play

1. Unit characteristics of the killer and victim (side, posture, reinforcing relationship, combat power orientation, and unit subtype of the killer).

2. Combat systems characteristics in each unit (range, type of attrition algorithm, ammunition used, and fuel used).

3. Environmental characteristics (daylight condition, weather, distance between units, and terrain type).

4. Firepower reallocation factors generated in conjunction with the standard victim force (database input).

5. Distance to and posture of the attriting unit. Within a decisive engagement distance, more intense attrition may occur.

6. Whether the victim is trying to move through a minefield that the killer is covering (21: 7-113 - 7-114).

Combat is initiated when a non-covert unit enters or tries to enter a new hex. If that unit is adjacent to or in a hex containing an enemy unit, JTLS determines if the units are capable of attriting each other. This depends on (1) the side of the killer, (2) day or night, (3) the weather index, (4) the killer's posture, and (5) the victim's posture. Based on this, it is possible that attrition may occur. Additionally, at least one of the unit's weapons systems (direct or indirect) must be able to reach the other unit (21: 7-114). If either unit can attrit the other, attrition will be assessed at the next ASSESS.COMBAT.TIME (see Time Advance Mechanism).

The following is a summary of the key rules concerning Lanchester attrition:

a. A combat system may be an indirect fire system, a direct fire system, or a non-killer, but only one type.

b. Direct fire systems use the Aimed-Fire Algorithm, which may kill as many as all the enemy combat systems. Indirect fire systems use the Area-Fire Algorithm, which may kill only this systems oriented toward the hex edge to which they themselves are oriented. Non-killers do not cause kills, but are subject to being killed.

c. A combat system may attrit an enemy system only if it is within range. Range is computed as the geographic distance between the centers of each unit, less the sum of the unit radii. Every combat system whose maximum range is greater than or equal to the range between the units may attrit. Each combat system type has its own maximum effective range.

d.　Sufficient ammunition is required; if not present, units can be reduced to ineffectiveness.

e.　Units that have run out of fuel may have some combat systems penalized in effectiveness.

f.　Units with no personnel are reduced to incapable status.

g.　A unit in combat with another may only use the fraction of its combat systems that are oriented toward the hex side between them to attrit the other unit.

h.　No unit can lose more combat systems than it has operational; weapons in maintenance cannot be attritted.

i.　Combat systems belonging to reinforcing units are not attritted in combat involving the reinforced unit.

j.　A killer unit faced with a hex containing more than 1 victim divides whatever combat systems it can bring to bear among all victims in proportion to the number of victim combat systems they each have.

k.　A victim unit that is with the decisively engaged distance of the attriting unit is attritted as though it were in "attack" posture.

l.　Units that are designated as special operations force (SOF) units have a special multiplier applied to their results as a killer; this is a "ferocity" multiplier of special units.

The actual casualties of a victim combat system type are found through the use of the attrition formulas shown in Table 4-12. For direct fire systems, FWL(i,j,k) represents the number of enemy systems of type k killed by each attriting system of type j under the circumstances indicated by index i. For indirect fire systems, it is the fraction of the available enemy systems of type k that are killed by each friendly system of type j under circumstances i (22: A-257 - A-260). The actual casualties are simply the FWL coefficient modified to account for fire dispersion, ammunition availability, fuel availability, and whether the unit is a SOF unit.

pK Methodology. Except for Lanchestrian attrition and losses caused by mines, the damage done to objects in JTLS is caused by targetable weapons. Targetable weapons are employed by air defense systems to engage enemy air missions and cruise missiles; by air missions to engage other air missions, and to attack ground objects (units, targets, convoys, and air missions on the ground);

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by artillery units to fire artillery fire missions, by missile-capable land units to execute missile missions and by naval units for both missile and torpedo engagements (21: 11-1).

If the attribute of the targetable weapons specifies it as a point weapon, the pK methodology is used. The actual pK is derived form the objects equivalent target category. The number of rounds from the fire mission or air mission is determined plus the number of submunitions the targetable weapon has. Then it is modeled as a binomial draw to determine the number of kills. For point targets (bridges, tunnels), 1 random draw is performed and damage is assessed if there is at least 1 success. For units, combat systems, and supplies, the damage is assessed in increment of the combat system packet size. This is the number of combat systems that can be damaged by a single point weapon (22: A-153).

Expected Value Method. This is used for targetable weapons that are area weapons. A lethal area methodology is used an expected value result is modeled for most unit damage and some target damage. The expected value methodology is actually just a modified pK:

$$F = 1 - \exp(\frac{-NR \cdot LA}{CA})$$

where   F = Fractional casualties (or pK)

NR = Number of rounds

CA = Area covered by effects

LA = Lethal area

Air Attrition Process

Air is allocated through air tasking orders. Packages of varying types of aircraft or individual, single aircraft missions can be executed. Aircraft will fly at their most efficient altitude for fuel consumption purposes. When calculating air routes, missions will avoid known SAM/AAA site, if possible. JTLS models air-to-air, air-to-ground and ground-to-air engagements.

In air-to-air, the firing of weapons is considered simultaneous. Based on a number of conditions (including weather, time of day, etc.), a pK is determined for each target-shooter pairing. For each weapon shot, a random number is drawn to determine if the victim is killed.

The method to assess results of air-to-ground relies on the nature of the weapon used: area or point. If a point weapon, then a pK methodology with a random draw determines outcome. If an area weapon, then a lethal area methodology is used, resulting in damage to the effected target based on an expected value calculation.

Ground-to-air engagements use a pK methodology and random number draw to determine the destruction wrought by each missile type.

Appendix B. Prototype PSYOP Task Listing

PSYOP Directed Against a Military Target:

Conventional Operations - Defensive:

Use loudspeakers to support conventional defensive operations by demoralizing enemy troops.

Use printed materials to support conventional defensive operations by demoralizing enemy troops.

Use radio and/or TV to support conventional defensive operations by demoralizing enemy troops.

Use loudspeakers to support conventional defensive operations by urging enemy surrenders.

Use printed materials to support conventional defensive operations by urging enemy surrenders.

Use radio and/or TV to support conventional defensive operations by urging enemy surrenders.

Conventional Operations - Offensive:

Use loudspeakers to support conventional offensive operations by demoralizing enemy units.

Use printed materials to support conventional offensive operations by demoralizing enemy units.

Use radio and/or TV to support conventional offensive operations by demoralizing enemy units.

Use loudspeakers to support conventional offensive operations by urging enemy surrenders.

Use printed materials to support conventional offensive operations by urging enemy surrenders.

Use radio and/or TV to support conventional offensive operations by urging enemy surrenders.

PSYOP Directed Against a Civilian Target:

Consolidation Operations:

Use loudspeakers to support consolidation operations by gaining local population cooperation.

Use printed materials to support consolidation operations by gaining local population cooperation.

Use radio and/or TV to support consolidation operations by gaining local population cooperation.

Use loudspeakers to support consolidation operations by searching for supplies and personnel.

Use printed materials to support consolidation operations by searching for supplies and personnel.

Use radio and/or TV broadcasts to support consolidation operations by searching for supplies and personnel.

Use loudspeakers to support consolidation operations by separating combatants and noncombatants.

Use printed materials to support consolidation operations by separating combatants and noncombatants.

Use radio and/or TV to support consolidation operations by separating combatants and noncombatants.

Use loudspeakers to support consolidation operations by disseminating public information.

Use printed materials to support consolidation operations by disseminating public information.

Use radio and/or TV to support consolidation operations by disseminating public information.

Special Operations - Direct Action:

Use printed materials to support special operations direct action missions by limiting/negating the effects of compromise.

Use radio and/or TV to support special operations direct action missions by limiting/negating the effects of compromise.

Special Operations - Special Reconnaissance:

Use printed materials to support special operations special reconnaissance missions by limiting/negating the effects of compromise.

Use radio and/or TV to support special operations special reconnaissance missions by limiting/negating the effects of compromise.

Special Operations - Foreign Internal Defense:

Use loudspeakers to support special operations foreign internal defense missions by making HN intentions known.

Use printed materials to support special operations foreign internal defense missions by making HN intentions known.

Use radio and/or TV to support special operations foreign internal defense missions by making HN intentions known.

Use loudspeakers to support special operations foreign internal defense missions by discrediting insurgent forces.

Use printed materials to support special operations foreign internal defense missions by discrediting insurgent forces.

Use radio and/or TV to support special operations foreign internal defense missions by discrediting insurgent forces.

Special Operations - Counterterrorism:

Use radio and/or TV to support special operations counterterrorism missions by making U.S. intentions known.

Use radio and/or TV to support special operations counterterrorism missions by discrediting terrorist forces.

Use radio and/or TV to support special operations counterterrorism missions by limiting/negating the effects of compromise.

Conventional Operations - Offensive:

Use loudspeakers to support conventional offensive operations by separating combatants and noncombatants.

Use printed materials to support conventional offensive operations by separating combatants and noncombatants.

Use radio and/or TV to support conventional offensive operations by separating combatants and noncombatants.

Contingency Operations - Disaster Assistance:

Use loudspeakers to support contingency operation disaster assistance missions by projecting a favorable U.S. image.

Use printed materials to support contingency operation disaster assistance missions by projecting a favorable U.S. image.

Use radio and/or TV to support contingency operation disaster assistance missions by projecting a favorable U.S. image.

Use loudspeakers to support contingency operation disaster assistance missions by disseminating public information.

Use printed materials to support contingency operation disaster assistance missions by disseminating public information.

Use radio and/or TV to support contingency operation disaster assistance missions by disseminating public information.

Contingency Missions - Noncombatant Evacuation:

Use loudspeakers to support contingency noncombatant evacuation operations by disseminating public information.

Use printed materials to support contingency noncombatant evacuation operations by disseminating public information.

Use radio and/or TV to support contingency noncombatant evacuation operations by disseminating public information.

Use loudspeakers to support contingency noncombatant evacuation operations by separating combatants and noncombatants.

Use printed materials to support contingency noncombatant evacuation operations by separating combatants and noncombatants.

Use radio and/or TV to support contingency noncombatant evacuation operations by separating combatants and noncombatants.

Contingency Missions - Security Assistance Surge:

Use loudspeakers to support contingency operation security assistance surges by building support for the HN government.

Use printed materials to support contingency operation security assistance surges by building support for the HN government.

Use radio and/or TV to support contingency operation security assistance surges by building support for the HN government.

Appendix C. Prototype Flowcharts

```
Given:          The current time
                COMBAT SYSTEMS array


| Loop (each PSYOP unit)
        | TIME.TEL = TIME.NOW
        | Fraction = 0
        | Loop (each equipment operational system)
                | Fraction = (Operational Systems Now / TOE Number) + Fraction
        | End loop
        | TEL =  (Fraction / Total number of equipment operational systems) * 100
        | TIME.DEGRADE.TEL =  TIME.TEL + 24 hours
| End loop
```

Initialize TEL Psuedocode

```
                    ┌─────────┐
                    │  Enter  │
                    └────┬────┘
                         │
                         ▼
          ┌──────────────────────────────┐
          │   TIME.TEL = TIME.NOW         │
          └──────────────┬───────────────┘
                         │
                         ▼
```

$$TEL = \frac{\displaystyle\sum_{I=1}^{N}\left(\frac{\text{Operational Systems Now}_I}{\text{TOE Number}_I}\right)}{N} \cdot 00$$

```
                         │
                         ▼
          ┌──────────────────────────────┐
          │   Schedule Degrade TEL        │
          │   at TIME.TEL+24 hours        │
          └──────────────┬───────────────┘
                         │
                         ▼
                    ┌─────────┐
                    │ Return  │
                    └─────────┘
```
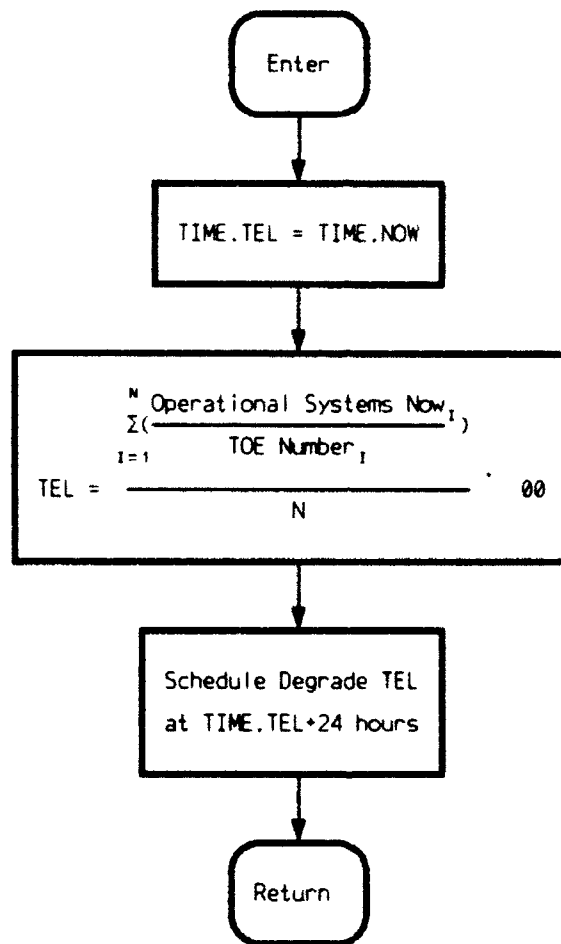
Initialize TEL

```
Given:          PSYOP Unit ID
                TIME.NOW
                TIME.TEL
                TIME.DEGRADE.TEL
                Degradation Rate, D


| For PSYOP Unit ID
| If TIME.DEGRADE.TEL > or = TIME.NOW
      | TIME.TEL = TIME.NOW
      | TIME.DEGRADE.TEL = TIME.TEL + 24 hours
      | TEL = TEL * (1 - D/100)
| Else
      | TIME.DEGRADE.TEL = TIME.TEL + 24 hours
| End if
```

Degrade TEL Value Psuedocode

```
                    ┌─────────┐
                    │  Enter  │
                    └────┬────┘
                         │
                         ▼
                      ╱──────╲
                     ╱   Is   ╲
                    ╱ TIME.TEL ╲
                   ╱  + 24 hours ╲      No      ┌──────────────────────┐        ┌─────────┐
                  ╱    > or =     ╲────────────▶│  Schedule Degrade TEL at │───────▶│  Return │
                   ╲  TIME.NOW    ╱             │  TIME.TEL + 24 hours     │        └─────────┘
                    ╲     ?      ╱              └──────────────────────┘
                     ╲──────────╱
                         │ Yes
                         ▼
                ┌────────────────────┐
                │  TIME.TEL = TIME.NOW │
                └─────────┬──────────┘
                          │
                          ▼
                ┌────────────────────┐
                │  Schedule Degrade TEL │
                │  at TIME.TEL+24 hours │
                └─────────┬──────────┘
                          │
                          ▼
                ┌────────────────────┐
                │ TEL = TEL * (1-D/100) │
                └─────────┬──────────┘
                          │
                          ▼
                     ┌─────────┐
                     │  Return │
                     └─────────┘
```
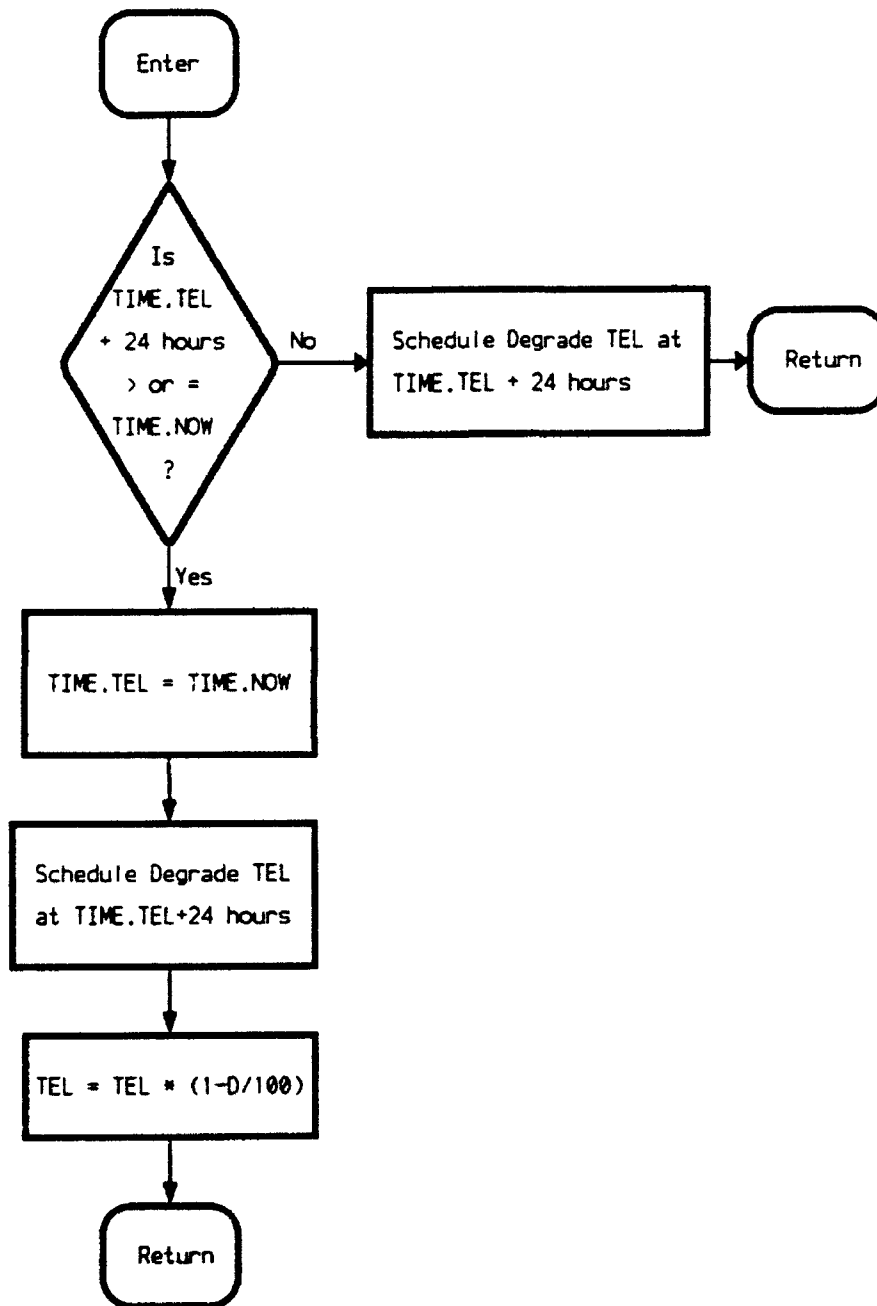
Degrade TEL Value

```
Given:        TIME.NOW
              PSYOP Unit ID
| For PSYOP Unit ID
| TIME.TEL = TIME.NOW
```

Update TEL Psuedocode

```
        ┌─────────┐
        │  Enter  │
        └────┬────┘
             │
             ▼
    ┌──────────────────────┐
    │                      │
    │  TIME.TEL = TIME.NOW │
    │                      │
    └──────────┬───────────┘
               │
               ▼
        ┌─────────┐
        │ Return  │
        └─────────┘
```
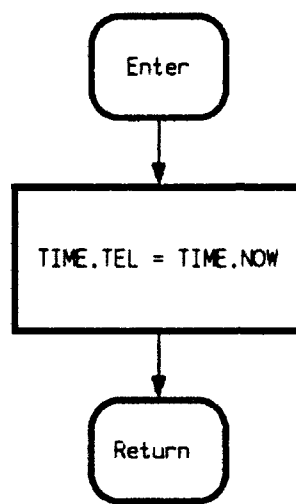
Update TEL

```
Given:          PSYOP Unit ID

                PSYOP Product Mission

                PSYOP Product Media

                MATL.REQD = f (mission, media), amount of raw material required

                MATL.AVAIL, amount of raw material currently available

                Q.RAW, quantity of product able to be produced (under ideal conditions)

                PER.REQD = f (media, Q.RAW), personnel required (under ideal conditions)
                         to produce Q.RAW of media

                PERS.AVAIL, personnel currently available

                RATE.PROD = f (media), time per amount of product produced

                TIME.DEVEL.RAW = f (media), time to develop a PSYOP product (given a
                         perfect target audience analysis)

                TIME.NOW

                TEL

| For PSYOP Unit ID
| If MATL.AVAIL < MATL.REQD
        | Notify player not enough material available to produce PSYOP product requested
        | Send a requisition (PSC 6-16)
        | Delay production until material arrives
| End if
| If PERS.AVAIL < PERS.REQD
        | If PERS.AVAIL = 0
                | Notify player no personnel available to produce PSYOP product requested
                | Delay production until personnel become available
        | End if
        | PERS.AVAIL = 0
        | PAX.AVAIL = PERS.REQD
| End if
| If PERS.AVAIL > or = PERS.REQD
        | PERS.AVAIL = PERS.AVAIL - PERS.REQD
        | PAX.AVAIL = PERS.REQD
| End if
| Loop (each equipment operational system)
        | Fraction = (Operational Systems Now / TOE Number) + Fraction
| End loop
| TIME.AVAIL = (Q.RAW * (Fraction / Total number of equipment operational systems) *
                (PAX.AVAIL / PERS.REQD) * RATE.PROD) +
                (TIME.DEVEL.RAW / (TEL/100)) + TIME.NOW
```

Product Development & Production Psuedocode

```
         ┌─────────┐
         │  Enter  │
         └────┬────┘
              │
              ▼
          ╱───────╲
         ╱   Is    ╲                    ┌──────────────────────────┐
        ╱ MATL.AVAIL ╲      No          │ - Notify Player          │         ┌─────────┐
       ╱  > or =     ╲─────────────────▶│ - Psuedocode 6-16,       │────────▶│ Return  │
        ╲ MATL.REQD  ╱                  │   "Send a Recquisition"  │         └─────────┘
         ╲    ?     ╱                    │ - Delay Production       │
          ╲───────╱                     └──────────────────────────┘
              │
             Yes
              │
              ▼
          ╱───────╲                        ╱───────╲
         ╱   Is    ╲                      ╱   Is    ╲
        ╱ PERS.AVAIL ╲      No           ╱ PERS.AVAIL ╲       No
       ╱  > or =     ╲──────────────────▶╱      =      ╲──────────────────────┐
        ╲ PERS.REQD  ╱                    ╲      0      ╱                      │
         ╲    ?     ╱                      ╲     ?     ╱                       │
          ╲───────╱                        ╲─────────╱                        │
              │                                 │                             │
             Yes                               Yes                            │
              │                                 │                             │
              ▼                                 ▼                             ▼
   ┌──────────────────────┐        ┌──────────────────────┐      ┌──────────────────────┐
   │ PERS.AVAIL = PERS.AVAIL-│      │ - Notify Player       │      │ PERS.AVAIL = 0        │
   │            PERS.REQD  │       │ - Delay Production    │      │                       │
   │                      │        └──────────┬───────────┘      │ PAX.AVAIL = PERS.REQD  │
   │ PAX.AVAIL = PERS.REQD │                   │                  └──────────┬────────────┘
   └──────────┬───────────┘                   ▼                             │
              │                           ┌─────────┐                       │
              │                           │ Return  │                       │
              │                           └─────────┘                       │
              │                                                             │
              └──────────────────────────────┬──────────────────────────────┘
                                              ▼
```

$$
TIME.AVAIL = Q.RAW * \frac{ASSETS.AVAIL}{TOE.ASSETS} * \frac{PAX.AVAIL}{PERS.REQD} * RATE.PROD + \frac{TIME.DEVEL.RAW}{(TEL/100)} + TIME.NOW
$$

```
                                              │
                                              ▼
                                          ┌─────────┐
                                          │ Return  │
                                          └─────────┘
```

Product Development & Production

```
Given:          PSYOP Unit ID
                PSYOP product delivery means = f (media)


| For PSYOP Unit ID and product media type
| If PSYOP unit has organic delivery means
        | Schedule delivery
| Else
        | If delivery is to be by aircraft
                | Schedule delivery
        | End if
        | If delivery is to be by artillery
                | Schedule delivery
        | End if
| End if
```

Deliver/Disseminate Product Psuedocode

```
            ┌─────────┐
            │  Enter  │
            └────┬────┘
                 │
                 ▼
              ╱  Does  ╲
             ╱   the PSYOP ╲
            ╱   unit have   ╲   Yes    ┌──────────────────┐      ┌─────────┐
            ╲    organic    ╱─────────▶│ - Schedule Delivery│─────▶│ Return  │
             ╲   delivery  ╱           └──────────────────┘      └─────────┘
              ╲  assets  ╱
                 ╲ ? ╱
                 │ No
                 ▼
              ╱  Is  ╲                  ┌────────────────────────────────────┐
             ╱ delivery ╲     Yes       │ - Psudeocode 6-43,                 │      ┌─────────┐
            ╱ by aircraft ╲────────────▶│   "Dispatch the Shipment"          │─────▶│ Return  │
            ╲      ?      ╱             │ - Psuedocode 8-22,                 │      └─────────┘
             ╲          ╱               │   "Airlift/Airdrop Loading Supplies"│
              ╲        ╱                │ - Psuedocode 8-24,                 │
                 │ No                   │   "Airdrop of Supplies"            │
                 ▼                      └────────────────────────────────────┘
              ╱  Is  ╲                  ┌────────────────────────────────────┐
             ╱ delivery ╲     Yes       │ - Psudeocode 6-43,                 │      ┌─────────┐
            ╱ by artillery╲────────────▶│   "Dispatch the Shipment"          │─────▶│ Return  │
            ╲      ?      ╱             │ - Psuedocode 7-24,                 │      └─────────┘
             ╲          ╱               │   "Create and Schedule Next Fire Mission"│
                 │ No                   └────────────────────────────────────┘
                 ▼
            ┌─────────┐
            │ Return  │
            └─────────┘
```

Deliver/Disseminate Product

```
Given:          Target type


| If target = military
        | If target = foreign military
                | Evaluate Foreign Army Discriminate Function Psuedocode
        | Else
                | Evaluate Homeland Army Discriminate Function Psuedocode
        | End if
| Else
        | Evaluate Civilian Target Psuedocode
| End if
```

Evaluate PSYOP Effectiveness Psuedocode

```
                    ┌─────────┐
                    │  Enter  │
                    └─────────┘
                         │
                         ▼
                       ╱   ╲
                      ╱     ╲
                     ╱  Is   ╲        ┌──────────────────────┐      ┌─────────┐
                    ╱ target  ╲  No   │ Call Civilian Target │      │ Return  │
                    ╲ military ╱─────▶│      Psuedocode      │─────▶│         │
                     ╲        ╱       └──────────────────────┘      └─────────┘
                      ╲   ?  ╱
                       ╲   ╱
                         │
                        Yes
                         │
                         ▼
                       ╱   ╲
                      ╱     ╲
                     ╱  Is   ╲        ┌──────────────────────────┐   ┌─────────┐
                    ╱ target  ╲  No   │ Call Evaluate Foreign Army│  │ Return  │
                    ╲ a foreign╱─────▶│  Discriminate Functions  │──▶│         │
                     ╲  army  ╱       │        Psuedocode        │   └─────────┘
                      ╲   ?  ╱        └──────────────────────────┘
                       ╲   ╱
                         │
                        Yes
                         │
                         ▼
            ┌──────────────────────────┐
            │ Call Evaluate Homeland Army│
            │  Discriminate Functions   │
            │        Psuedocode         │
            └──────────────────────────┘
                         │
                         ▼
                    ┌─────────┐
                    │ Return  │
                    └─────────┘
```
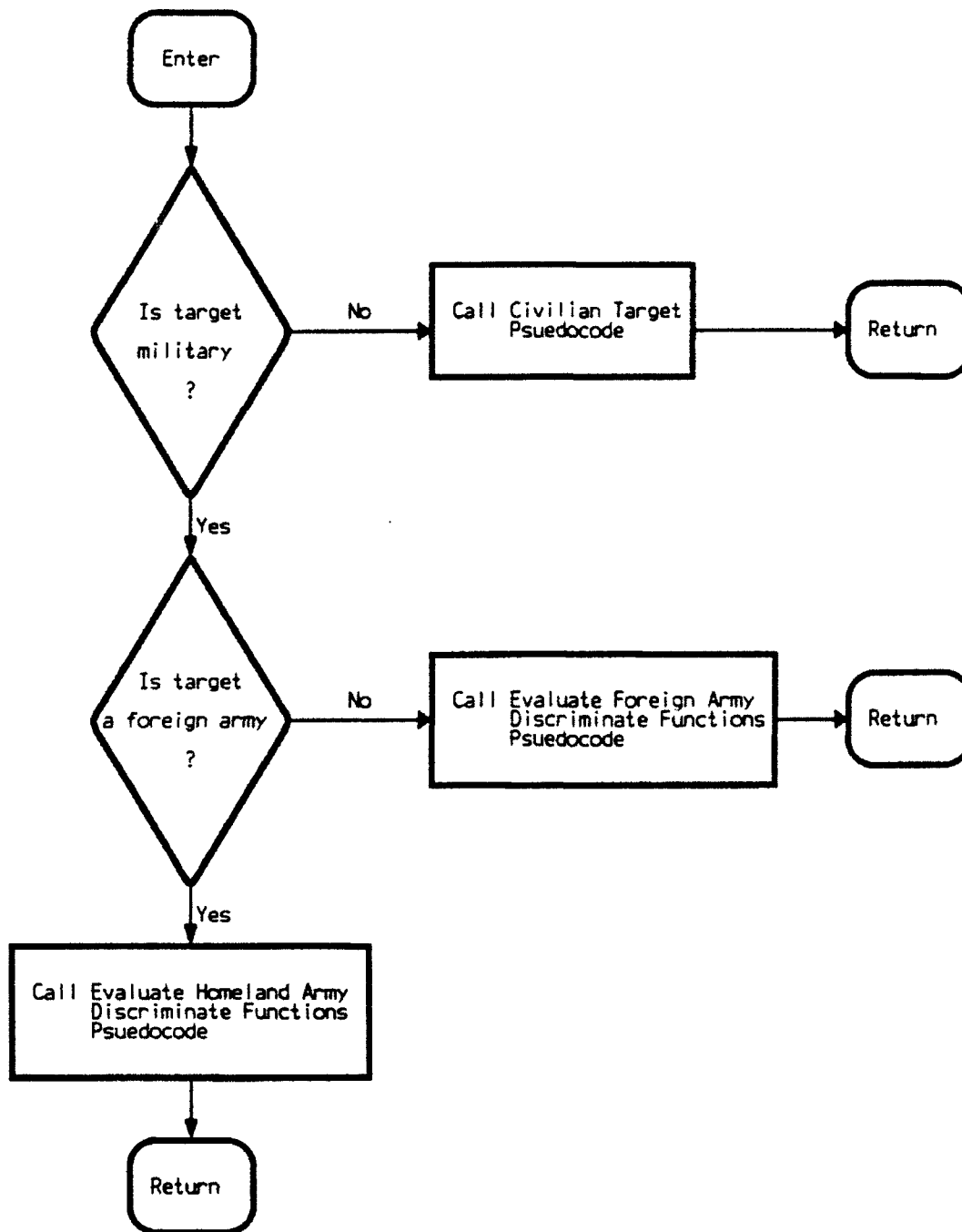
Evaluate PSYOP Effectiveness

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```
Given:          Scale values A through G


| FOR.O = -736.14 + 17.50A - 5.86B - 2.74C - 3.27D - 5.90E - 1.80F + 8.29G
| If FOR.O > 0
        | PSYM = .8
        | If FOR.O > 250
                | PSYM = .5
        | End if
        | If FOR.O > 500
                | PSYM = .3
        | End if
| Else
        | FOR.EN = -629.13 + 13.52A - 3.40B - 5.92C + 3.56D - 2.74E - 0.57F + 4.38G
        | If FOR.EN > 0
                | PSYM = .8
                | If FOR.EN > 175
                        | PSYM = .5
                | End if
                | If FOR.EN > 350
                        | PSYM = .3
                | End if
| End if
```
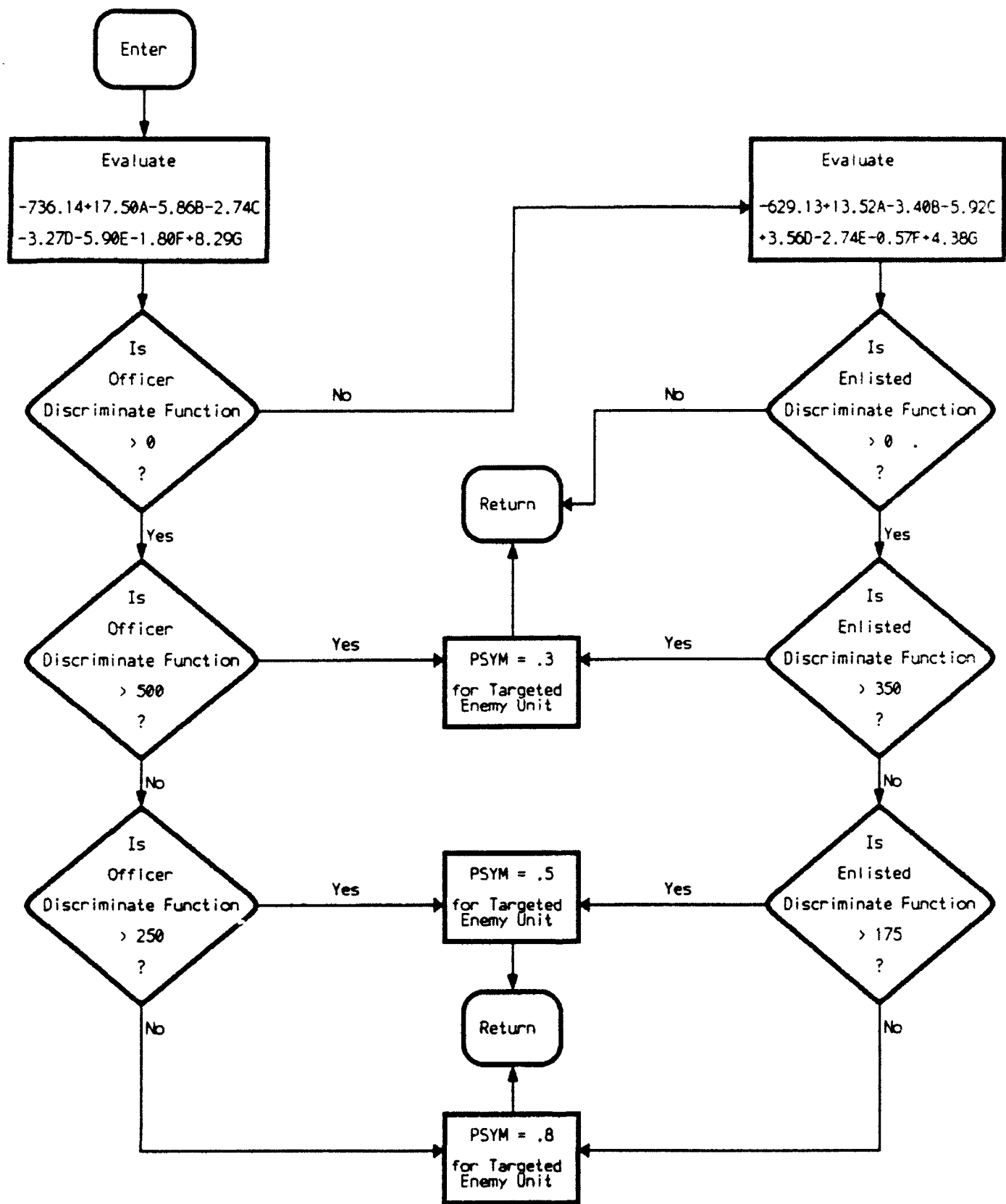
Evaluate Foreign Army Discriminate Functions Psuedocode

Foreign Army Discriminate Functions

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```
Given:          Scale values A through G


| HOME.O = -241.05 + 10.11A - 2.10B - 2.85C - 0.32D - 2.09E - 2.76F + 5.89G
| If HOME.O > 0
       | PSYM = .8
       | If HOME.O > 230
              | PSYM = .5
       | End if
       | If HOME.O > 460
              | PSYM = .3
       | End if
| Else

       | HOME.EN = -989.93 + 37.37A - 11.11B - 13.28C - 1.57D - 4.85E - 8.06F + 8.07G
       | If HOME.EN > 0
              | PSYM = .8
              | If HOME.EN > 360
                     | PSYM = .5
              | End if
              | If HOME.EN > 720
                     | PSYM = .3
              | End if
| End if
```
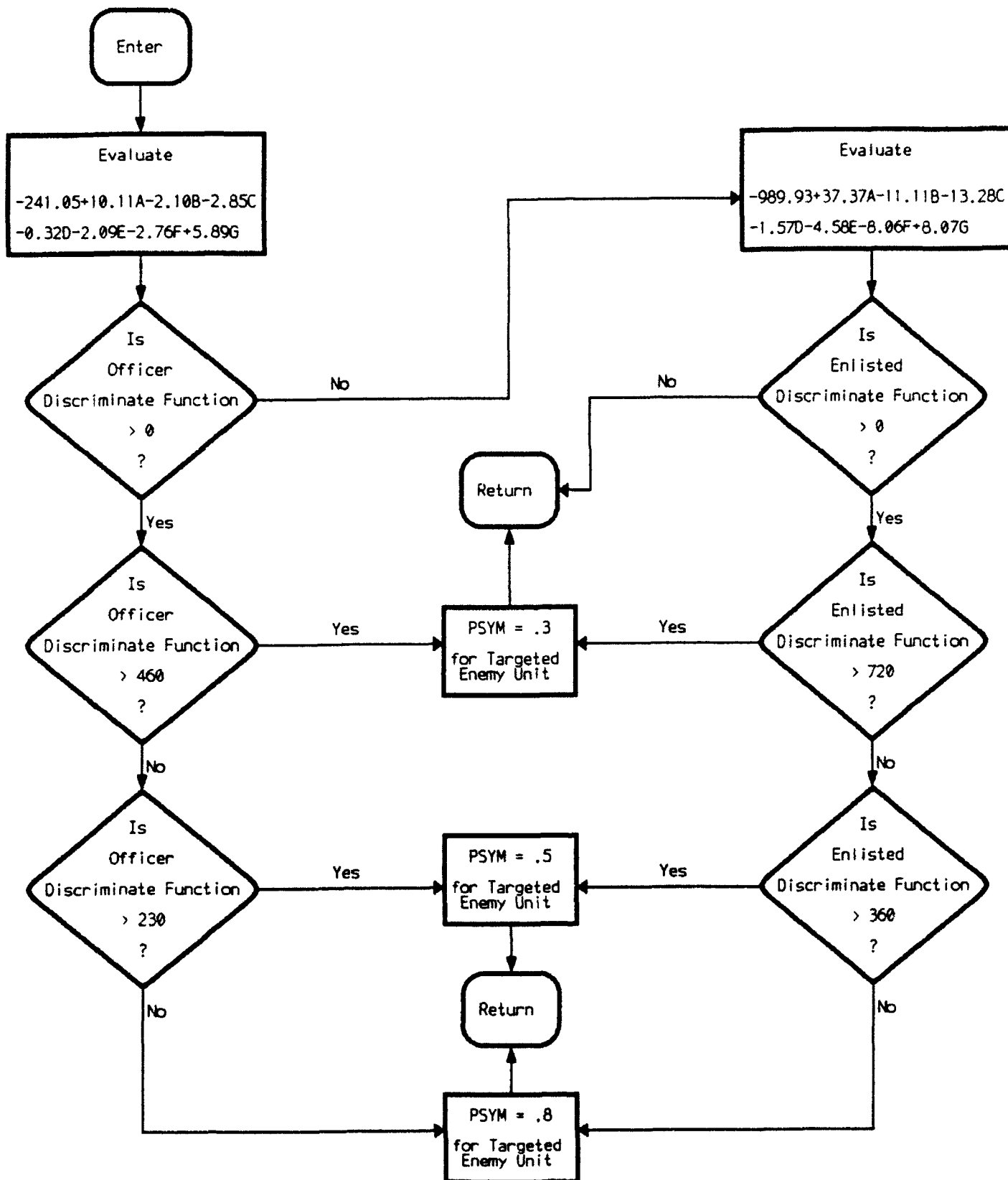
Evaluate Homeland Army Discriminate Functions Psuedocode
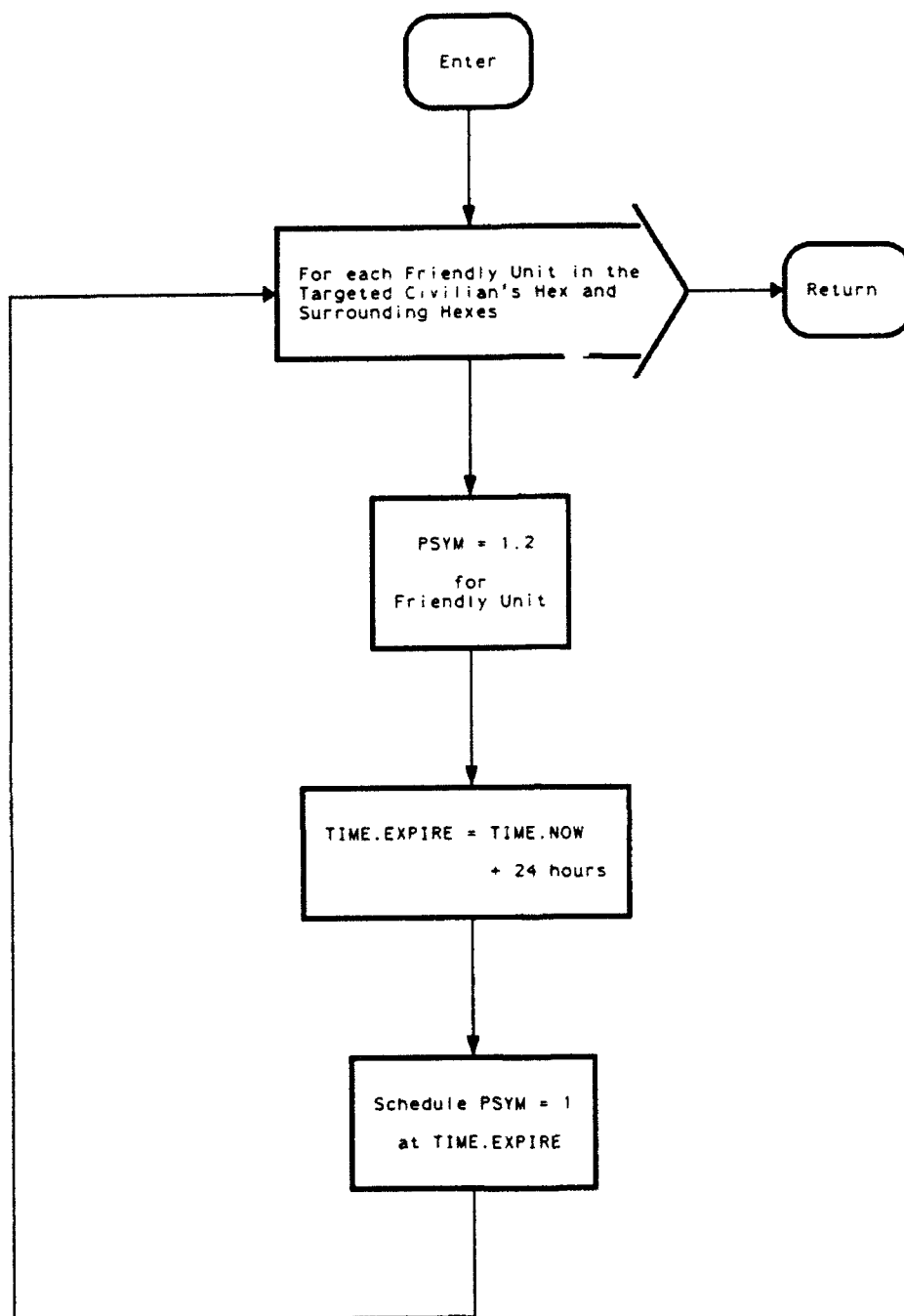
Homeland Army Discriminate Functions

```
Given:          Location of civilian target
                TIME.NOW


I  Loop (each friendly unit in the civilian targets hex and immediately surrounding hexes)
      I  PSYM = 1.2
      I  TIME.EXPIRE = TIME.NOW + 24 hours
      I  Schedule PSYM = 1 at TIME.EXPIRE
I  End loop
```

Evaluate Civilian Target

```
                    ┌─────────┐
                    │  Enter  │
                    └─────────┘
                         │
                         ▼
        ┌──────────────────────────────┐
        │ For each Friendly Unit in the │────────►┌─────────┐
        │ Targeted Civilian's Hex and   │         │ Return  │
        │ Surrounding Hexes             │         └─────────┘
        └──────────────────────────────┘
                         │
                         ▼
              ┌─────────────────────┐
              │     PSYM = 1.2      │
              │        for          │
              │   Friendly Unit     │
              └─────────────────────┘
                         │
                         ▼
         ┌───────────────────────────────┐
         │ TIME.EXPIRE = TIME.NOW         │
         │               + 24 hours      │
         └───────────────────────────────┘
                         │
                         ▼
              ┌─────────────────────┐
              │  Schedule PSYM = 1  │
              │   at TIME.EXPIRE    │
              └─────────────────────┘
```

Civilian Target

Appendix D. Required Data Arrays

In Chapter 4, Model Development, I reference certain required data sets for use with this methodology. This appendix will outline what data sets are required for the JTLS programmers to collect and implement. Sources for all this may be found through the following:

Commander
4th Psychological Operations Group (Airborne)
ATTN: S3/Operations Officer
Fort Bragg, North Carolina 28307
POC: MAJ Furlong (S3)
AV 239-4108   CM (919) 432-4108

Commander
Company A, 3rd Battalion, 1st Special Warfare Training Group (Airborne)
ATTN: AOJK-GP-C-PD
Psychological Operations Officer's Course
Fort Bragg, North Carolina
POC: CPT Walters (Company Operations Officer)
AV 236-2103   CM (919) 396-2103

Commander
U.S. Special Operations Command
ATTN: SOJ9, Directorate of Psychological Operations and Civil Affairs
MacDill Air Force Base, Florida 33608-6001
POC: SFC Dana P. Jumper or COL Harold Youmans
AV 968-3142 CM (813) 830-3142

TIME.DEVEL.RAW

Purpose: Time it takes to develop a PSYOP product under ideal conditions

Units: days

Size: 3 dimensional array (30 values)

Elements:

Mission.   1. make U.S./HN intentions known, disseminate info. discredit enemy
           2. find supply caches/enemy personnel
           3. separate combatants and noncombatants
           4. limit negative effects
           5. demoralize the enemy; encourage surrenders

Audience: 1. civilian
           2. military

Media: 1. audio
           2. video
           3. print

MATL.REQD

Purpose: Amount of material required for the PSYOP mission

Units: lbs of leaflets
                ft of videotape
                ft of recording media

Size: 2 dimensional array (15 values)

Elements:

Mission.   1. make U.S./HN intentions known, disseminate info, discredit enemy
            2. find supply caches/enemy personnel
            3. separate combatants and noncombatants
            4. limit negative effects
            5. demoralize the enemy; encourage surrenders

Media: 1. audio
            2. video
            3. print

Q.RAW

Purpose: Quantity of PSYOP products able to be produced under ideal conditions

Units: Amount of product produced (i.e.. lbs leaflets. ft videotape)

Size: 2 dimensional array (15 values)

Elements:
                Mission.   1. make U.S./HN intentions known, disseminate info. discredit enemy
                            2. find supply caches/enemy personnel
                            3. separate combatants and noncombatants
                            4. limit negative effects
                            5. demoralize the enemy; encourage surrenders

                Media: 1. audio
                            2. video
                            3 print

RATE.PROD

Purpose: Time it takes to produce a given amount of PSYOP product

Units: time per amount of product produced (i.e., minutes per leaflet)

Size: 1 dimensional array (3 values)

Elements:
                Media: 1. audio
                            2. video
                            3. print

Appendix E. Assumptions

This appendix is a complete listing of assumptions on which my methodology is based.

1. The decision logic, specifically the combat events program, of the JTLS model has been verified.

2. The attrition logic (based on a full heterogeneous Lanchester model) has been verified.

3. Appropriate media selection has occurred as part of the PSYOP product development process.

4. The equipment assets available to a PSYOP unit have a direct relationship on the effectiveness of that unit's PSYOP analysis.

5. If a PSYOP unit has equipment, that unit will use such equipment perfectly; capability equals availability.

6. The TEL value contains many of the component parts of the analysis process that are important in PSYOP product development, such as regional/theater information that would impact on the time it takes to develop the PSYOP product.

7. For purposes of the TEL, all equipment types are equally important, taken as a class.

8. For purposes of the TEL, the TOE of a PSYOP unit is designed such that all assets are appropriate for that unit's mission.

9. The actual quantity of PSYOP product produced is a function of both personnel and equipment availability.

10. If classified as surrender, soldiers will willingly give up.

11. If classified as capture, soldiers will continue to fight and be either killed or captured through the force of arms.

12. The larger the positive value of the discriminate function, the more likely that unit is to surrender.

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13. ABSTRACT (Maximum 200 words)

This thesis provides a prototype and methodology for integrating psychological operations (PSYOP) into the Joint Theater Level Simulation (JTLS) combat model. The requirement rose out of the need for aggregate-level training models to reflect the role of PSYOP so that commanders and their staffs can learn how to manage, plan for, and conduct PSYOP within the context of AirLand battle doctrine. As the JTLS model currently exists, there is no representation of psychological operations whatsoever. This thesis outlines a methodology for incorporating the PSYOP analysis process (including the target audience analysis), the PSYOP product development and production process, the PSYOP product dissemination, and an estimation of its effects (if any) on military and civilian target audiences. Military target effects are explicit estimates; civilian effects are modeled on the aggregate level. The goal is an estimation of the impact of PSYOP on battlefields within the JTLS combat simulation. This thesis contains an overview of the JTLS model and a listing of data sources and assumptions.

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